The Electrical Industry's Weekly Magazine

March 24, 1958

Electrical World

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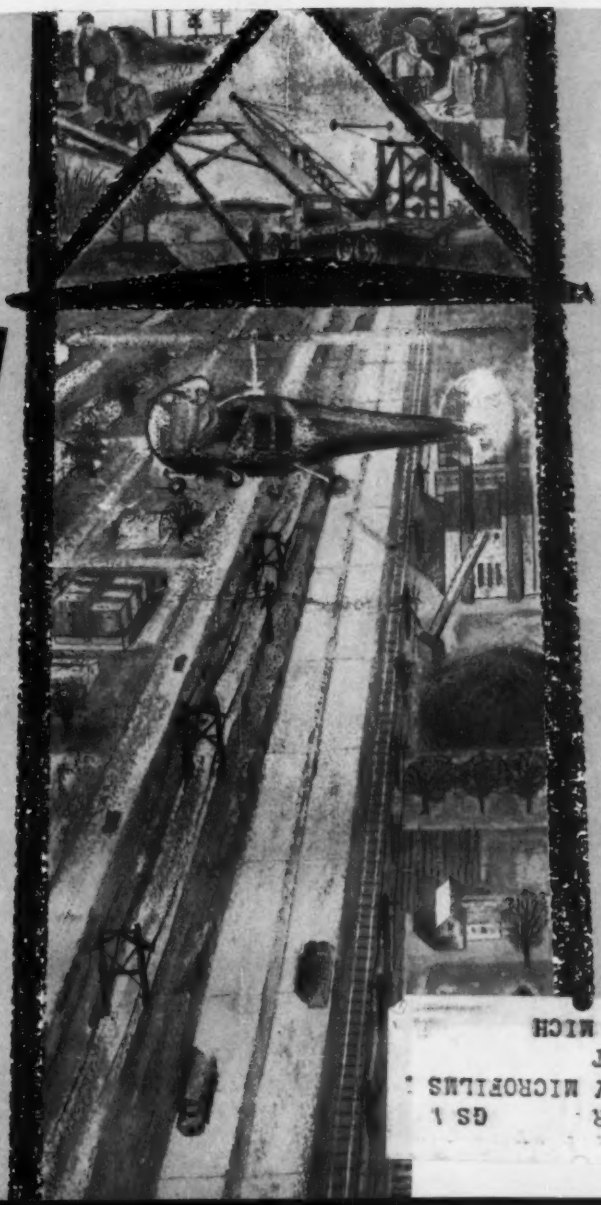
A McGraw-Hill Publication



Right-of-Way

How Utilities Are Cutting Costs – A Meeting Report...p 71

Electrical World Survey Shows Progress on Some Fronts...p 105

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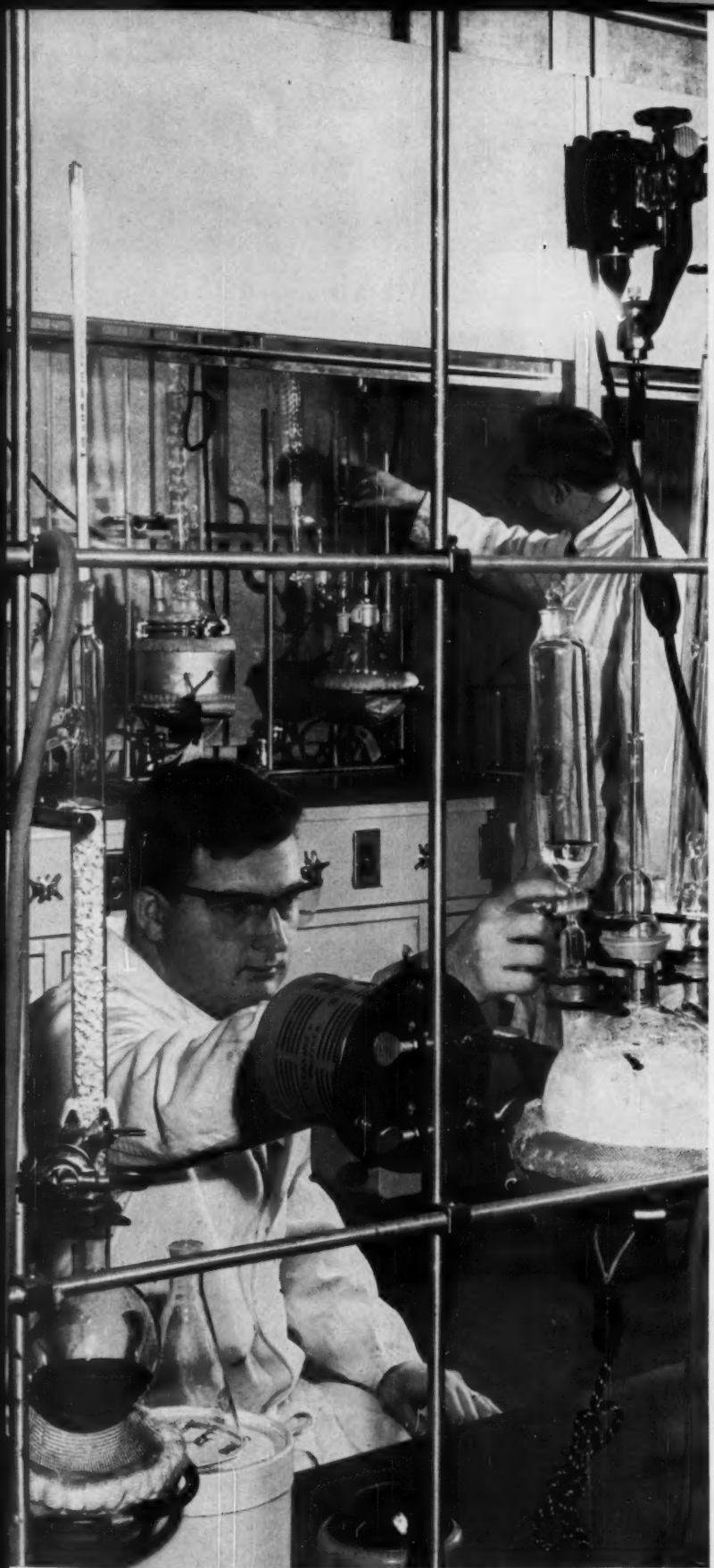
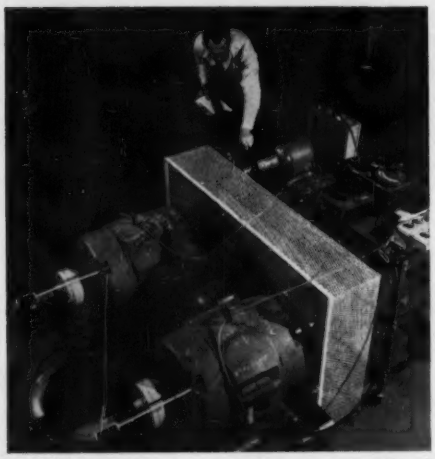


NEW MOTOR LABORATORY translates ideas into product advances. Example: Lab chemists studying resins and polymers; seeking materials with longer life at higher temperatures.



BEARINGS TEST in new Lab determines the life of ball bearings under various degrees of thrust loading.

Forward-looking research projects in progress at General Electric's Medium A-C Motor and Generator Department . . . new Development Laboratory delivers . . .

GREATER MOTOR VALUES FOR UTILITIES

General Electric's new A-C Motor Development Laboratory—located in Schenectady, N. Y.—is the first facility of its kind devoted solely to progress in motors. Staffed by over 100 skilled scientists and engineers, this research laboratory speeds the introduction of newer, better motors.

CURRENT RESEARCH suggests scope of Lab projects, and what they mean to important motor users like electric utilities. Important areas such as motor noise, insulation, bearings and lubrication are under continual exploration. For example, a thorough investigation of air flow and ventilation problems was recently completed. The result: "high-up" air intake and exhaust passages on an all-new weather-protected motor. And just last year exhaustive studies of sound absorbing materials resulted in a new acoustically treated top-hat to muffle operating noise in high-speed boiler feed pump motors.

HOW UTILITIES BENEFIT: Through the Laboratory and Advanced Engineering developments, utilities are assured of products to meet their motor needs now and in the future. General Electric Co., Schenectady 5, N. Y. 301-377

MORE POWER TO AMERICA

GENERAL ELECTRIC

Electrical World

Vol. 149, No. 12 MARCH 24, 1958

Published for 84 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

In This Week's Issue

CURRENT EVENTS

What Does AGA's 'Zinder Report' Mean?

Controversial pro-gas analysis of all-electric vs gas-and-electric service spells conflict ahead.....p 66

INDUSTRIAL

Cheap Speed Control for Motors Possible

D. W. Huszagh, Brookhaven National Laboratory

Varying motor terminal voltage provides relatively inexpensive speed control without instability.....p 77

MEETING REPORT

Right-of-Way Men Explore Cost Cutting

Key to most efficient, economical operations is long range planning, electric utility group told in Chicago.....p 71

SYSTEM ENGINEERING

Three Criteria for System Stability

B. L. Lloyd, C. A. DeSalvo, Westinghouse Electric Corp.

Stability studies require judgment of the type and severity of disturbances, operation of protective equipment and system conditions at the time of fault.....p 80

TRANSMISSION

115-Kv Cable to Cross Champlain

R. E. Moran, Uhl, Hall & Rich

St. Lawrence submarine adjunct will link Plattsburgh and Vermont across the lake.....p 75

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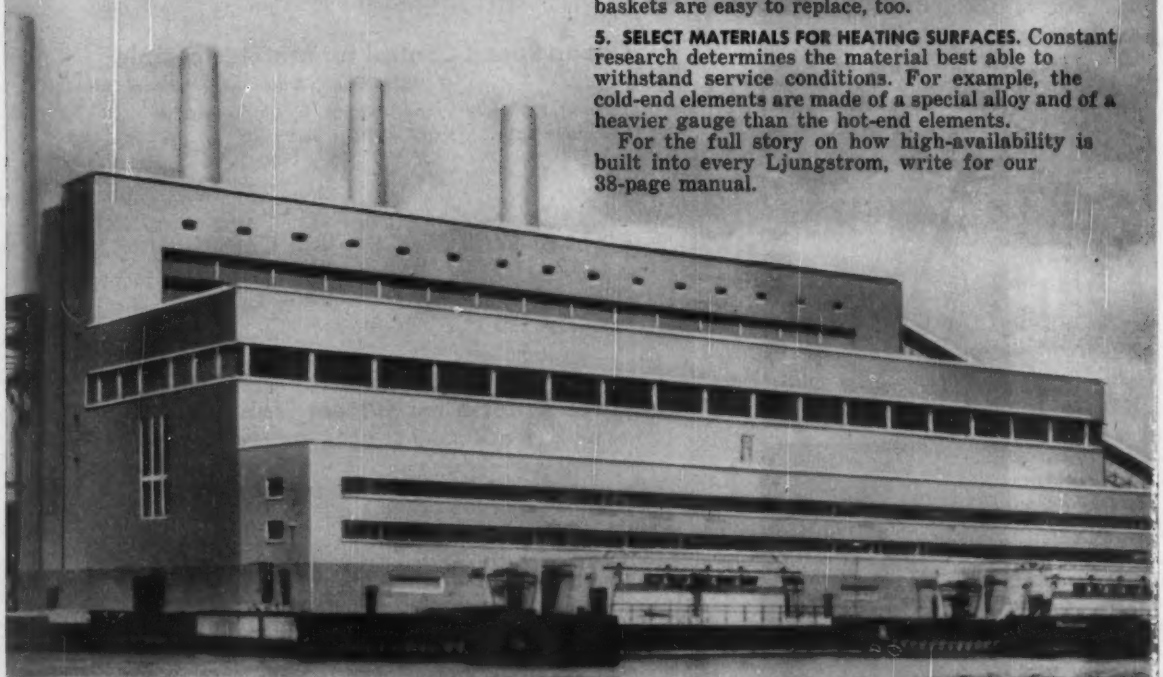

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Today more than 40 leading utilities use these reprints in quantities ranging from less than 100 to more than 3,000 per issue for distribution to their industrial customers.

With our 70th edition of the reprint to be issued this month, we are revamping the format, adding a second color, and attempting to make the reprint even more useable as a promotion piece for utilities.

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You may secure samples of our new Industrial Applications reprint and additional information by writing Ken McLean, Industrial Editor, Electrical World, 330 W. 42nd St. New York 36, N. Y.

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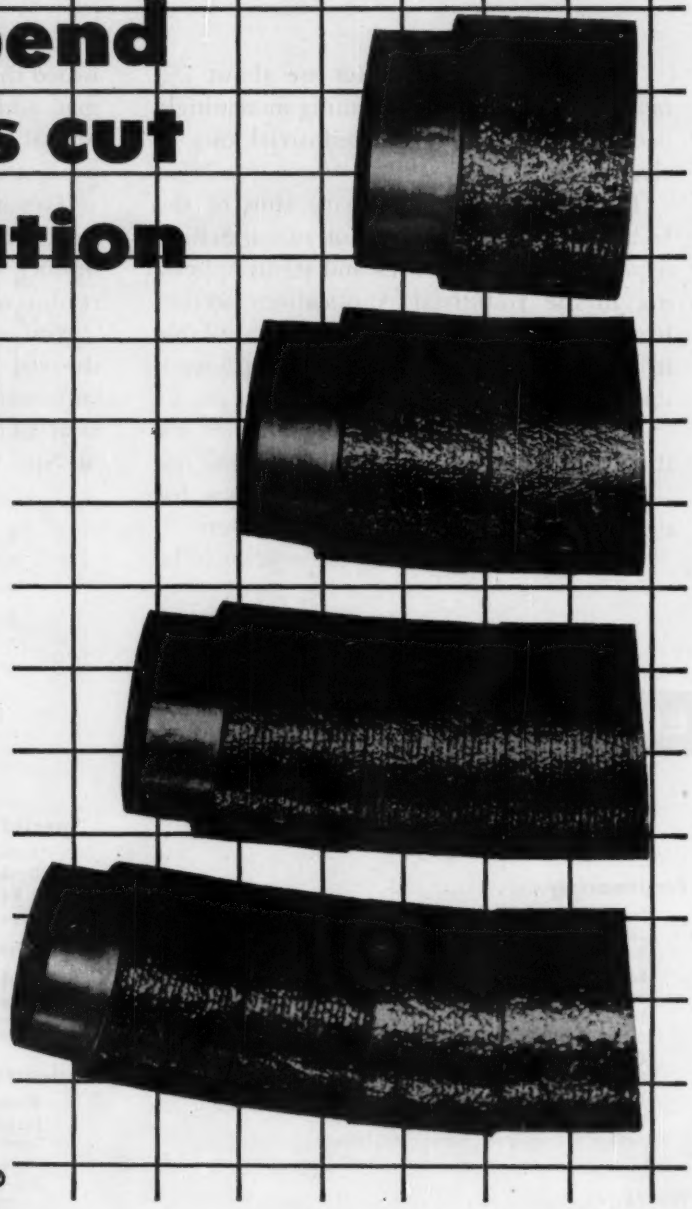
These bend sections cut installation costs



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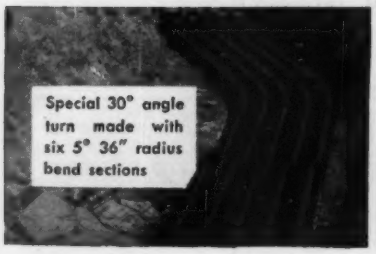

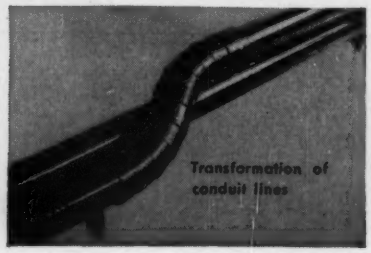

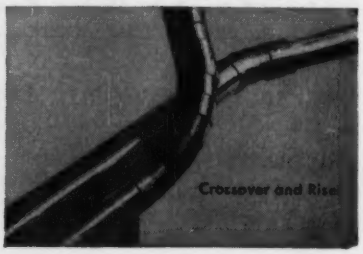

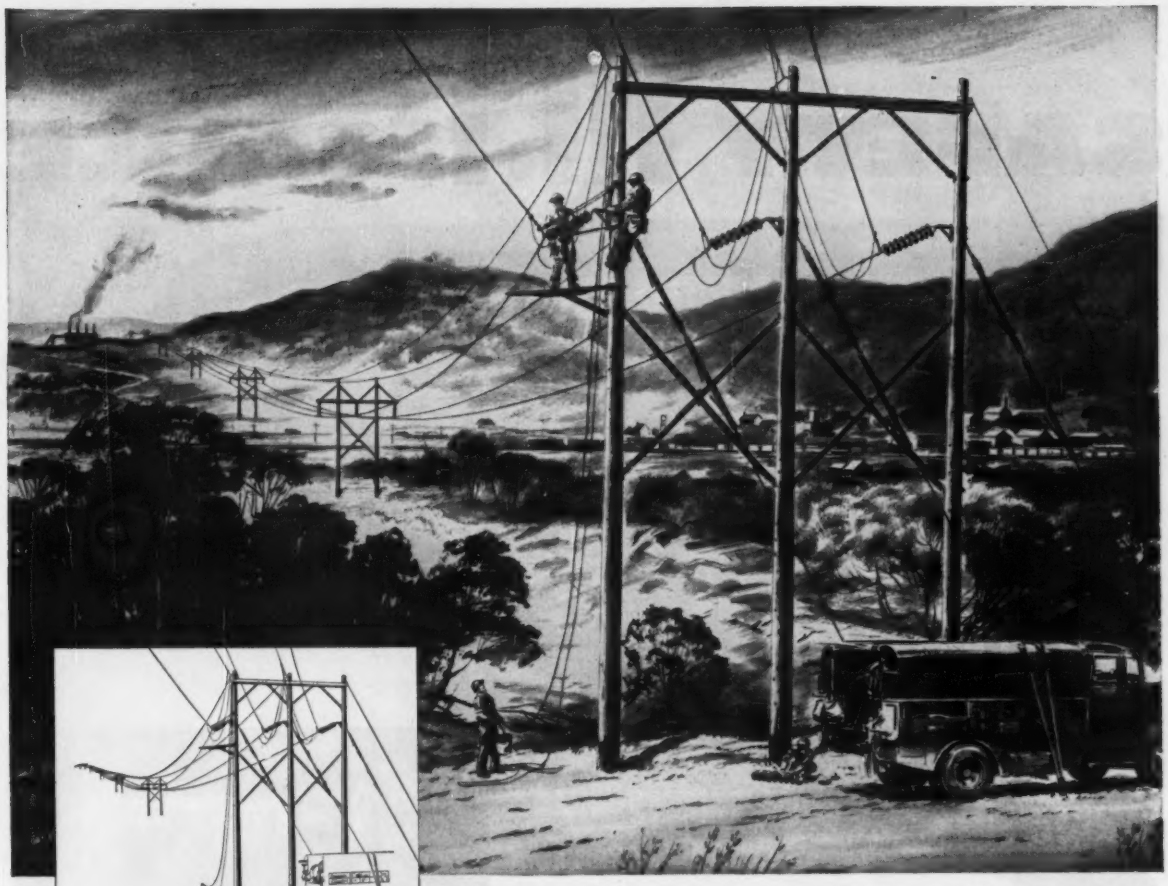

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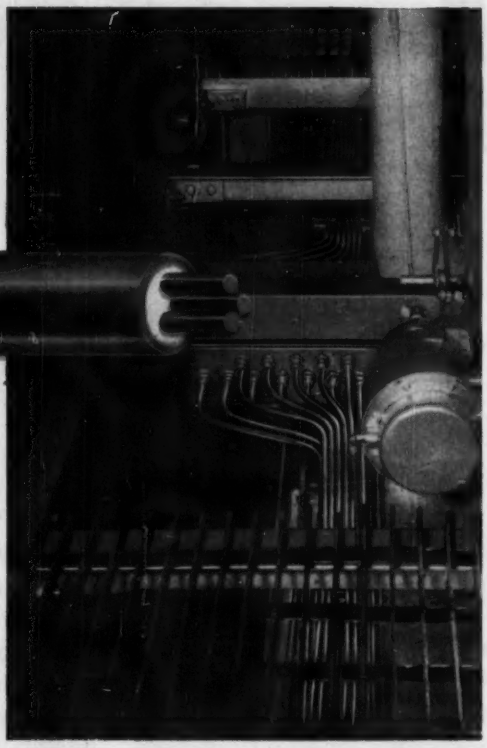

MI terminating in main Japan Oven control center switchboard at Poinsett Lumber and Manufacturing Company, Anderson, S.C.

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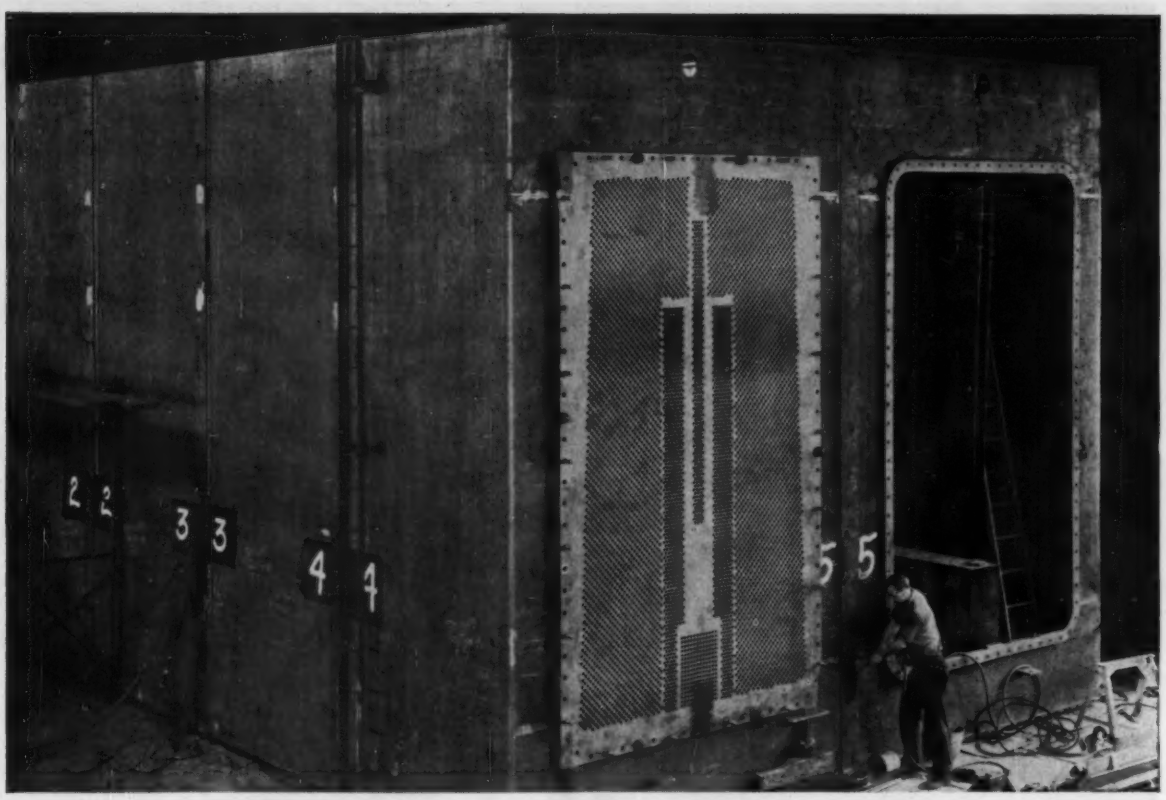
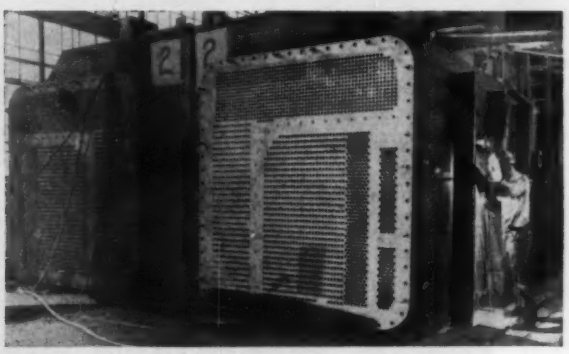


HERE'S ONE SHELL of this twin-shell, triple-lane unit just before shipment to Consolidated Edison's Astoria Station. It's designed to condense 1,600,000 lbs. steam/hr. at 1.87" Hg., with 244,000 gpm circulating water, and has 27,450 aluminum-brass tubes. Unit serves 335,000 kw turbine.

HUGE, SINGLE-PASS, 187,000 sq. ft. CONDENSER

... designed and built by C. H. Wheeler is now being installed at world's largest metropolitan utility

VICE-PRESIDENTS LEE YETTER and Roy Droescher, and Chief Engineer Paul Hamm are responsible for the design and construction of all Wheeler condensers. They work with engineers employed by C. H. Wheeler's customers, with turbine manufacturers' engineers and consulting engineers in BTU chasing.



TYPICAL REVERSE FLOW CONDENSER is this 35,000 sq. ft. unit for a Southern electric utility. Patented Reverse Flow feature permits flushing debris from tubes with only slight (and momentary) vacuum loss. Note low height to save head room, rectangular cross section to further utilize space for this Wheeler client.

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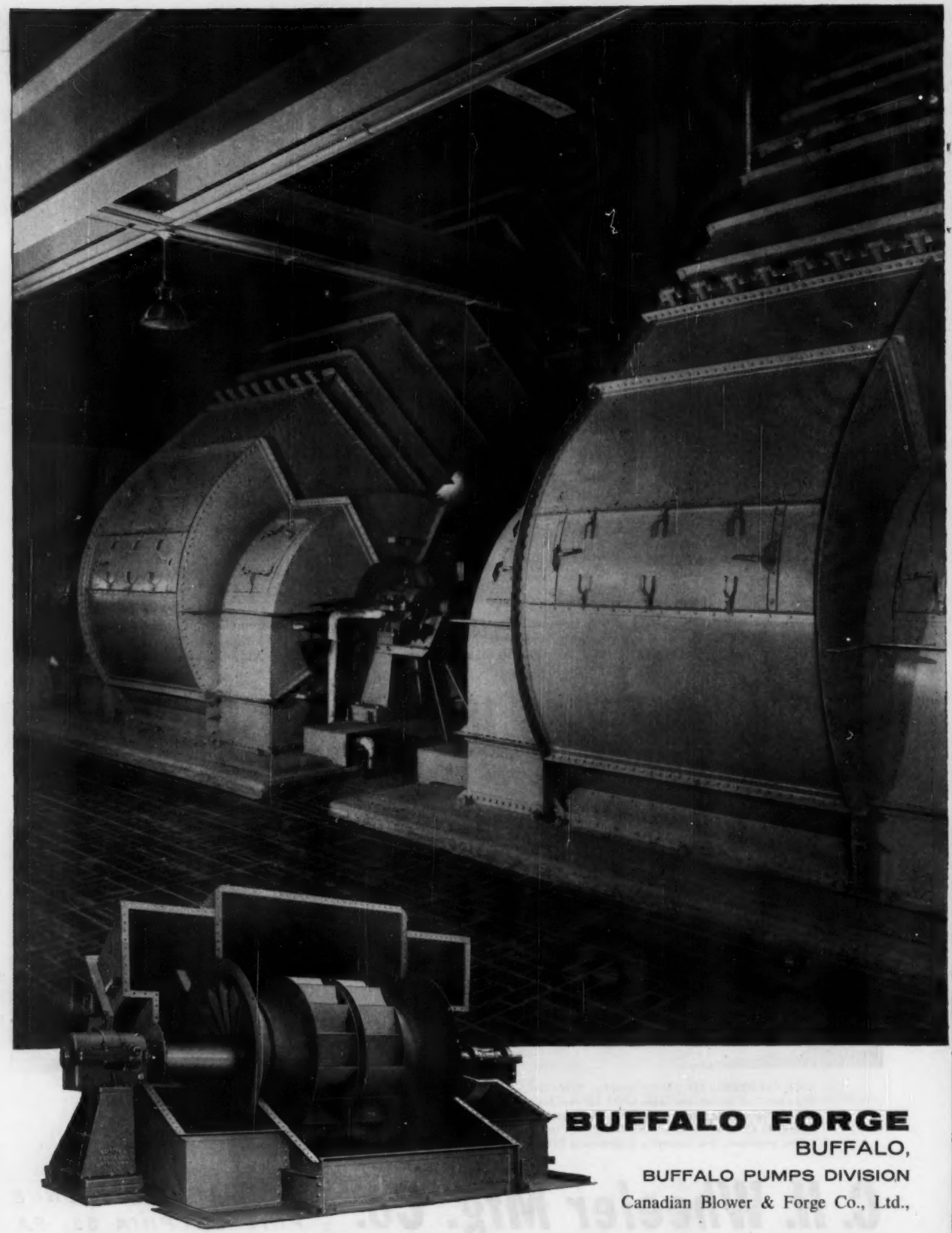

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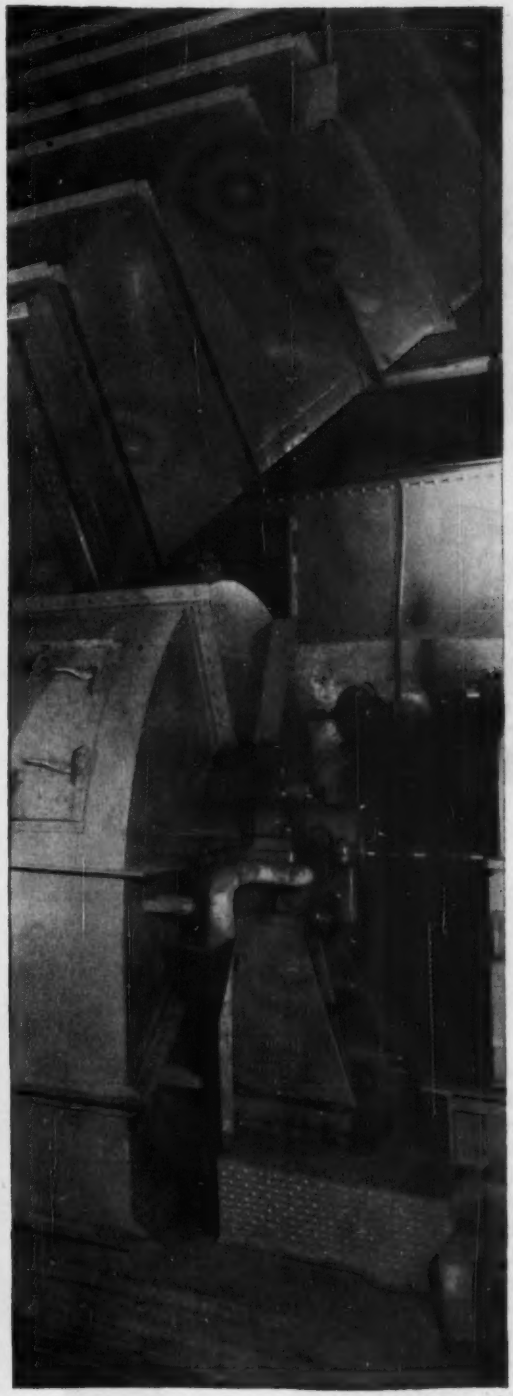

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COMPLETELY STREAMLINED INLET. Wheel flange and matching inlet bell form true half-circle, eliminating turbulence causing flat spots. GENEROUS INLET BOX DIMENSIONS give lower loss through inlet boxes than competitive makes, thus smoother air entry. VARIABLE INLET VANES, when used, are placed well into the inlet throat. Horsepower-reducing spin developed by the vanes is therefore fully utilized by the wheel. WHEEL DESIGN incorporates proper blade passages and air-flow through the wheel, in addition to airfoil blading, to produce maximum efficiencies. SCROLL shape lets air stream from blade passages to the housing channel with greatest ease. DIVERGENT OUTLET provides the optimum of static regain as the air passes from the cut-off, insuring the most efficient performance. Conventional outlet fans have a considerable amount of turbulence at this point.

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with

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Steel Driving Stud
for Sectional Ground Rods

Copper Bonded Pigtail

Type GUV
U-bolt ground clamp parallel or 90°

Type GG
Ground Rod Clamp
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Copper Alloy Coupling for Sectional Ground Rods

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Ground Rod Clamp
Square head bolt

Type B
Budget Line Ground Rod Clamp
Square head bolt

Type GP 100
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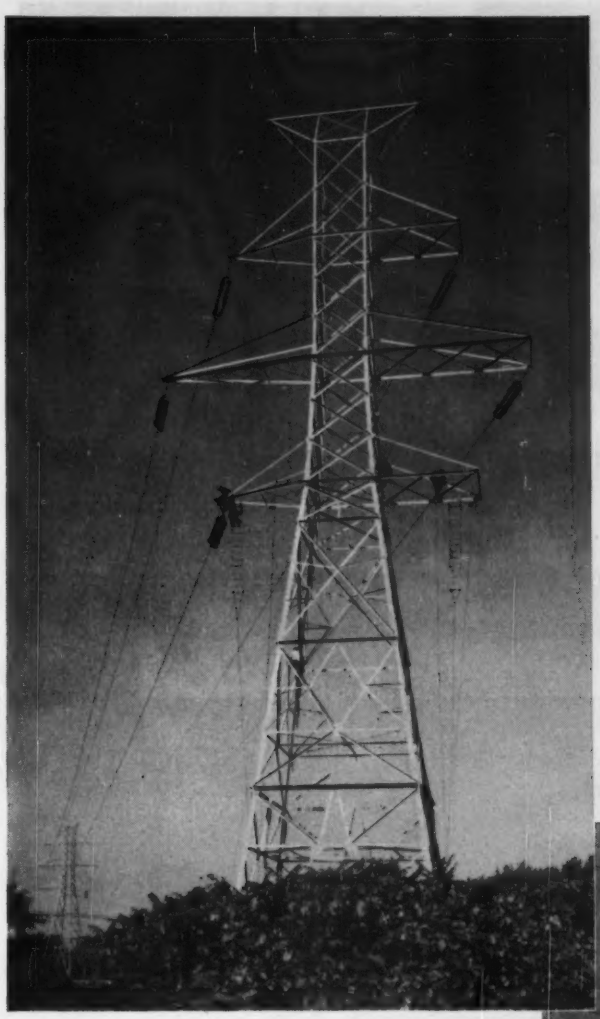
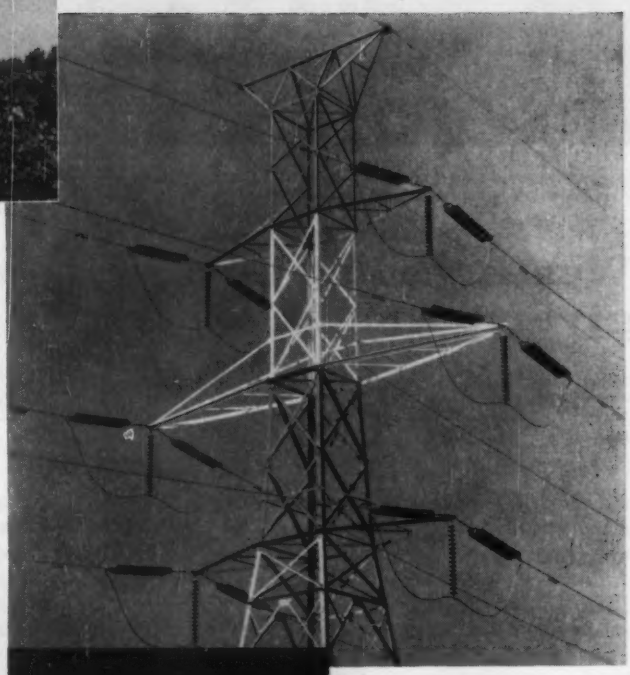


MORE Lapp 25,000-lb. insulators for NIAGARA-MOHAWK 230-kv system

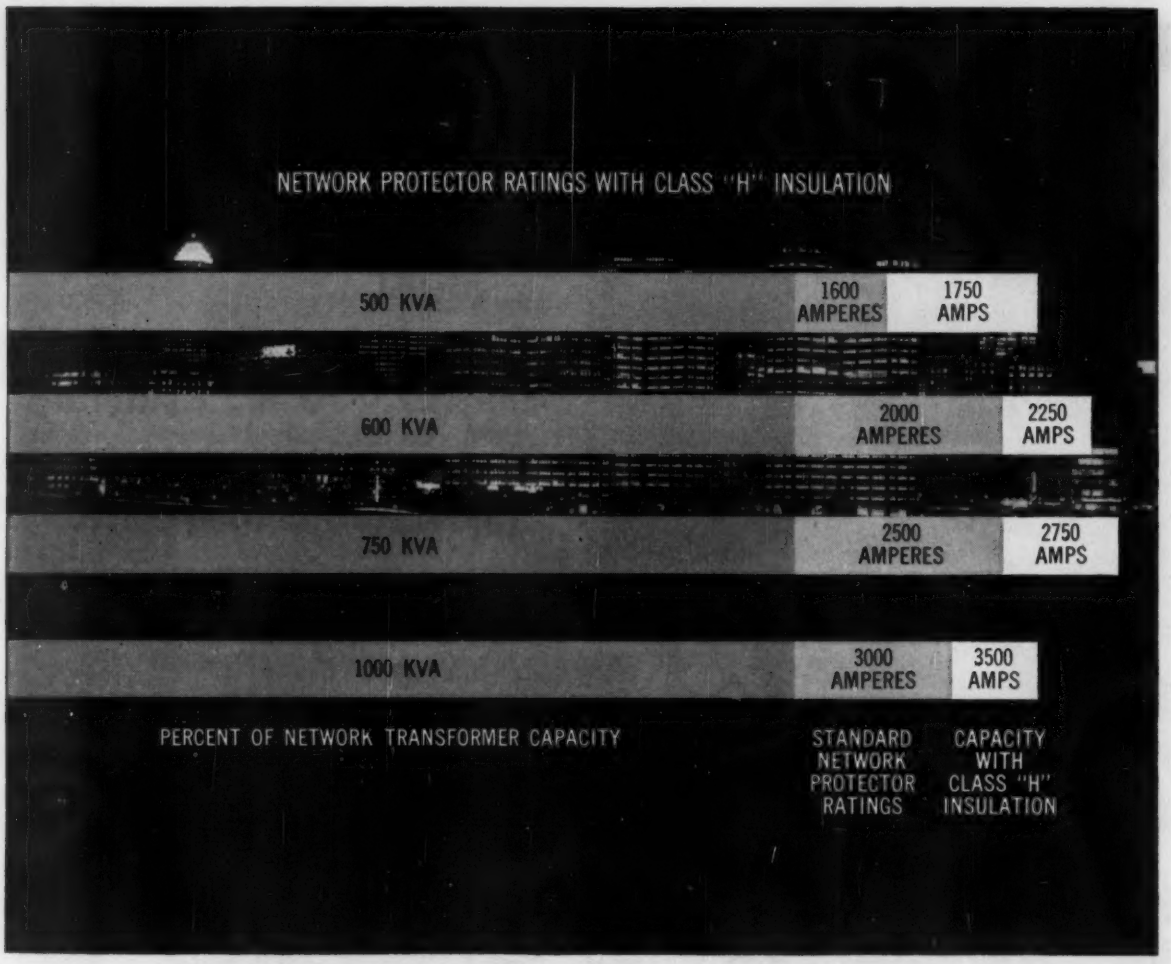


This new Huntley-Gardenville line on Niagara-Mohawk Corporation's system is 21 miles long, 230 kv, double circuit. Tower heights average 123 feet. Maximum span is 1250 feet, minimum span 400 feet. Conductor is 1192.5 MCM ACSR. Insulators used include Lapp No. 8200 (15,000-lb.) units in suspension strings; and Lapp No. 5960A (25,000-lb.) units, two-string yoked, for dead-ends, as shown here.

Niagara-Mohawk is one of many utilities whose service records on Lapp suspension insulators merit confidence. Lapp was pioneer in belief . . . and demonstration . . . that suspension insulators could combine electrical security, long life and consistent high strength. For your new construction at EHV . . . and regular transmission voltages . . . Lapp insulators will give you an extra margin of security in all these characteristics.

Lapp Insulator Co., Inc., Le Roy, N. Y.

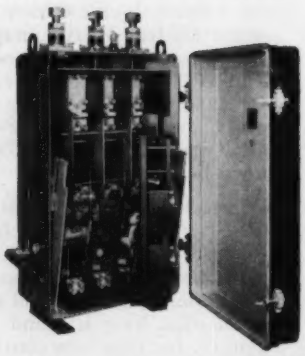
Lapp



Standard Network Transformer Ratings vs Standard Protector Ratings at 216 Volts (protector ratings shown with and without Class "H" insulation).

Westinghouse network protectors give you more capacity

Class "H" insulation extends protector ratings... another "Plowback of Earnings" bonus



Now, another improvement from Westinghouse research to help smooth over network system growing pains. Westinghouse Network Protectors have always provided a margin between maximum current rating of protectors and full-load current rating of network transformers. The addition of Class "H" insulation to protector relays and current transformers allows continuous operation at higher currents within temperature limits of the insulation.

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YOU CAN BE SURE...IF IT'S

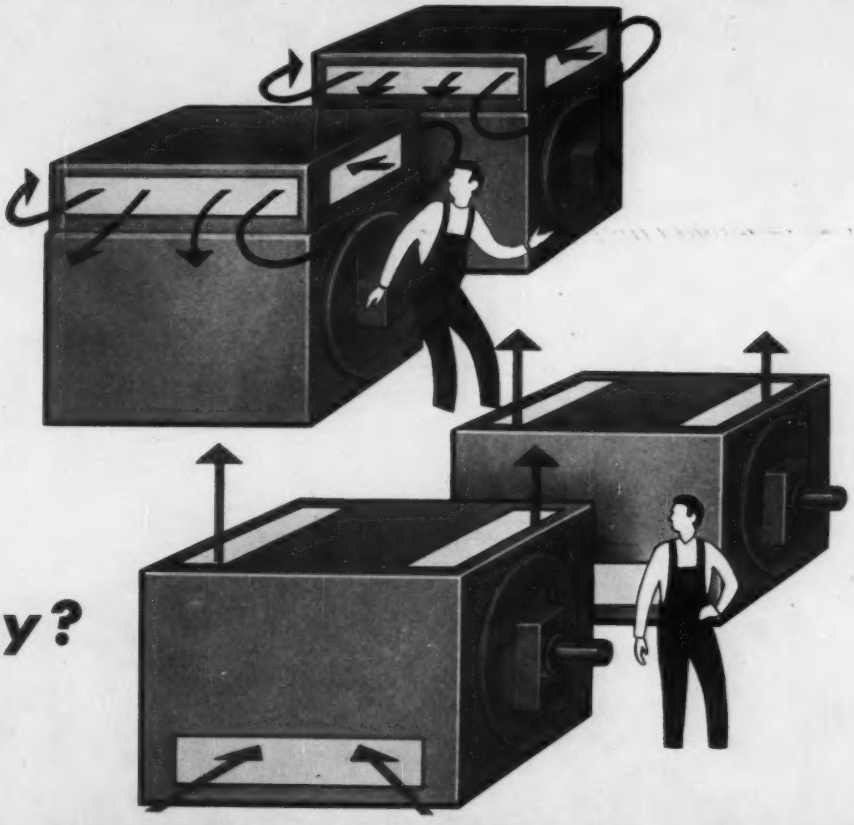
Westinghouse

How would YOU cool a boiler feed pump motor?

"Power plant engineers have suggested several big improvements in the conventional BF pump motor design. For a long time BF pump motors just weren't nice to be near. Now you have another (and we think better) motor design to choose from."—E. H. Jernberg, Chief E-M Mechanical Engineer.

this way?

(HOT AIR GOES 'ROUND AND 'ROUND)



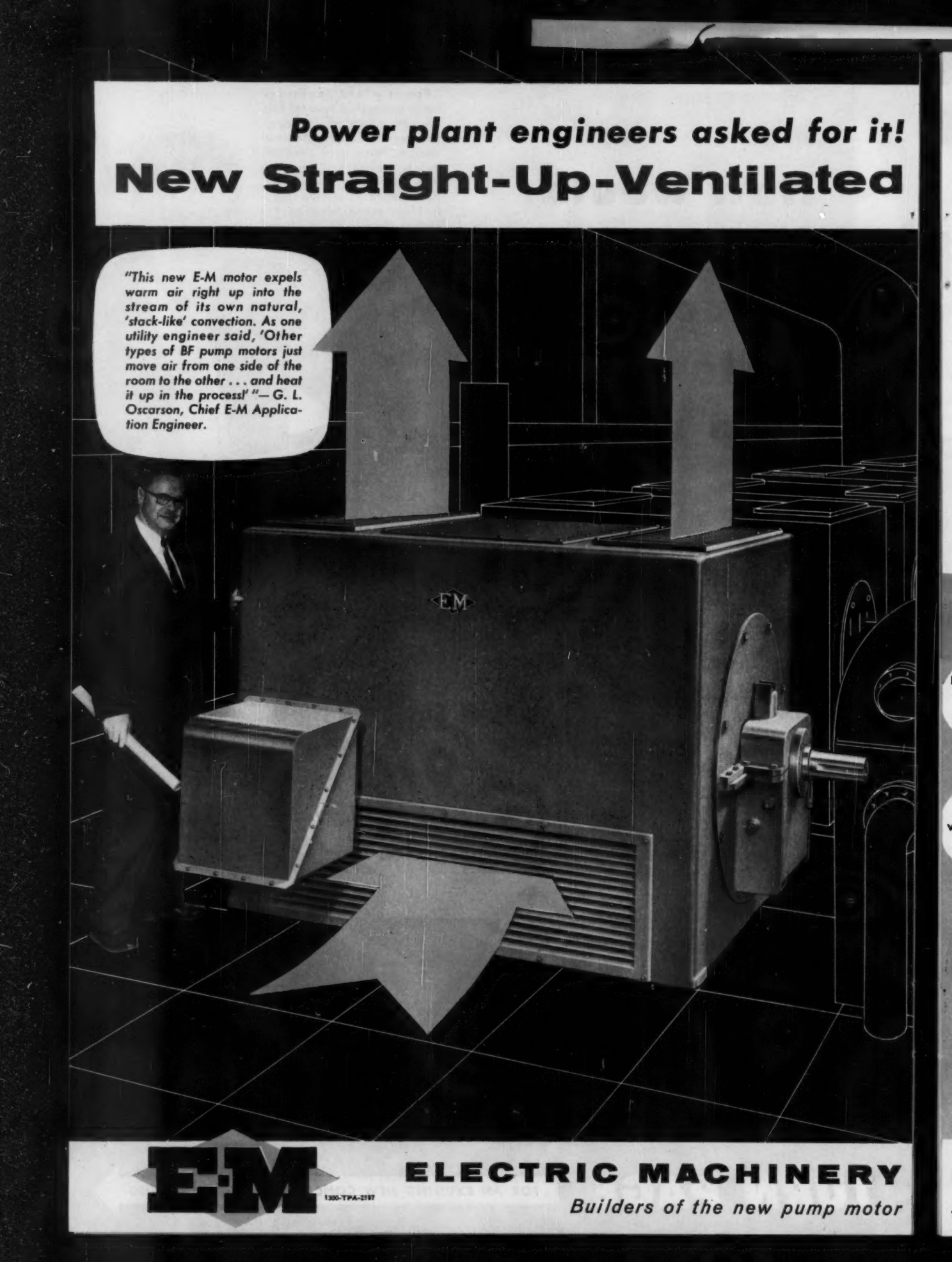
or this way?

(HOT AIR GOES "UP THE STACK")

TURN PAGE FOR AN EXCITING NEW CONCEPT IN MOTOR COOLING

Power plant engineers asked for it!

New Straight-Up-Ventilated


"This new E-M motor expels warm air right up into the stream of its own natural, 'stack-like' convection. As one utility engineer said, 'Other types of BF pump motors just move air from one side of the room to the other . . . and heat it up in the process!' "— G. L. Oscarson, Chief E-M Application Engineer.
E-M

E-M 1300-TPA-2597

ELECTRIC MACHINERY

Builders of the new pump motor

E-M *designed it! Here it is! The...*

Boiler Feed Pump Motor

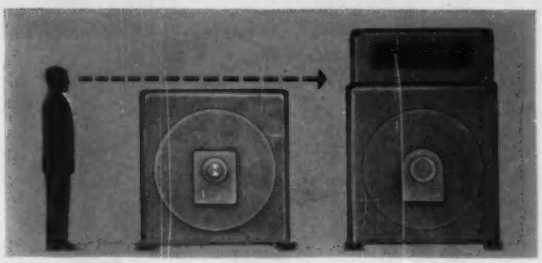
Blows warm air straight up and away!

It has FOUR GREAT NEW FEATURES you've always wanted:

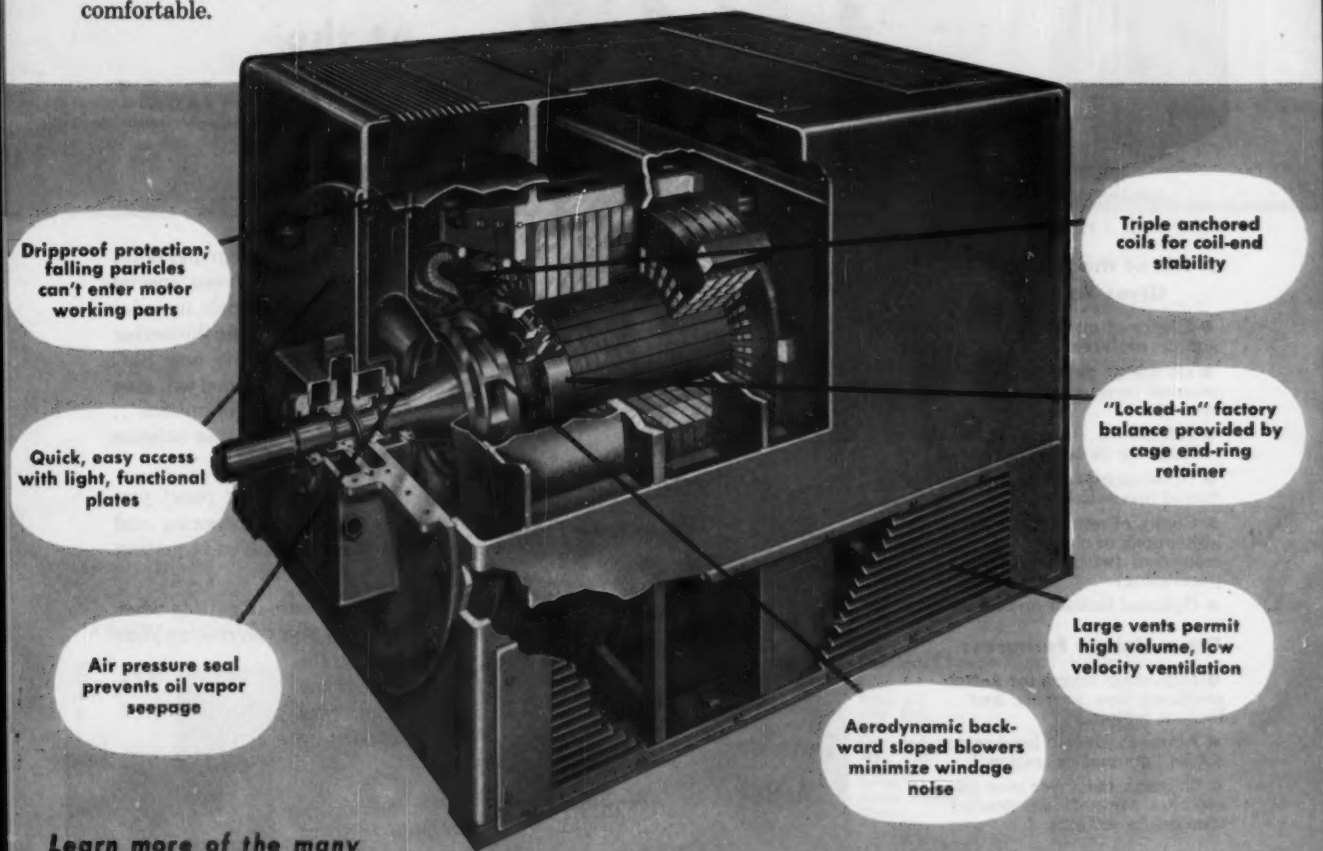
1. NEW TOP DISCHARGE. The new E-M motor ejects ventilating air straight up from the top. The heated discharge air rises straight to the ceiling.

2. COOLER INTAKE AIR. Split-level inlet-outlet prevents cross circulation and recirculation, permits close motor spacing.

3. GREATER OPERATOR COMFORT. No more "face blasting". The new E-M Motor eliminates warm air build-up at operator level, makes work more comfortable.



4. BETTER VIEW OF PUMP ROOM. View-blocking superstructures are gone. The new E-M design is low, modern, compact.


Dripproof protection; falling particles can't enter motor working parts
Quick, easy access with light, functional plates
Air pressure seal prevents oil vapor seepage
Triple anchored coils for coil-end stability
"Locked-in" factory balance provided by cage end-ring retainer
Large vents permit high volume, low velocity ventilation
Aerodynamic backward sloped blowers minimize windage noise

Learn more of the many

BIG DIFFERENCES THAT MAKE THE DIFFERENCE

Find out all about the motor that's "nice to be near." Call your nearby E-M Sales Engineer. Write today for Straight-Up-Ventilated Motor brochure, No. 1134W

MFG. COMPANY MINNEAPOLIS 13, MINNESOTA

that performs as well on the job as on the test stand

Now for "Preferred-Emergency" Switching

an Off-the-Shelf

AUTOMATIC TRANSFER PANEL

With *Any Desired* Throwover Scheme ...at the *Flip of a Switch!*

A Flip of the Switch Gives You:

- Choice of making either source preferred.
- Choice of automatic or manual (semi-automatic) return.
- Adjustable time delays —range up to 10 minutes.
- Optional manual operation of line switches.
- Choice of returning: in either open or closed transition (with or without paralleling).
- Optional lockout on bus faults.

Other Unique Features:

- Indicating lamps for switch positions, live sources, and lockout action.
- Alarm to prevent leaving panel set on "manual operation."
- Transparent cover over selector switches prevents unintended changes in settings.

Saves Time and Money

You don't have to design and build (or negotiate for) — your special automatic transfer panels in order to get the special specific throwover schemes you need. The new S&C Automatic Transfer Panel will give you any or all throwover options... selector switches give the scheme you want!

With this new stock panel you can eliminate the engineering and correspondence involved in getting custom-built panels.

Furthermore, you are sure of getting what you want today; tomorrow you can change your mind, and later you can revise the scheme—still using the same transfer panel. Imagine! You can order your panel ahead of time, before specifications are settled.

— Buy from our stock for your stock —

Specialists in High-Voltage Circuit Interruption since 1910

S&C ELECTRIC COMPANY

4421 RAVENSWOOD AVENUE • CHICAGO 40, ILLINOIS, U. S. A.

In Canada: S&C Electric Canada, Ltd., 8 Vansco Road, Toronto 14, Ontario

The Electrical Newsletter

FUTURE NEWS ▶ **It now looks as if Ike will renominate Lewis Strauss as AEC chief.** But a big Senate fight over confirmation is a certainty.

Arnold R. Jones has a good chance to be confirmed as TVA director. The former deputy budget director is a Kansas Republican.

LATE NEWS ▶ **Controlled recirculation boiling reactor has feature to reduce** capital and operating costs, C. G. Graham of Allis-Chalmers' Nuclear Power Div tells Nuclear Congress. CRBR is being designed for Northern States Power. He said expanding use of nuclear reactors should come soon, possibly in next generation of reactors.

CEI should receive a steady coal supply from the 108-mi pipeline running to its Eastlake plant in 90 days, when line is slated for commercial use, says Pittsburgh Consolidation Coal's James Hyslop.

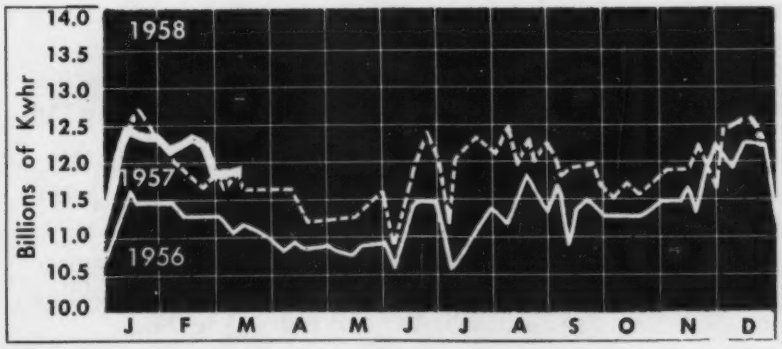
Seven-day strike ends at Consumers Power after UWUA agrees to two-year pact. Provisions: 5% wage boost for first year (about 12¢ an hour); flat 11¢ hr hike second year . . . OVEC-UWUA deadlock continues at Kyger Creek, but plant is still meeting AEC needs.

ASEA of Sweden wins contract for principal electrical equipment for proposed 37-mi, 200-kv DC submarine cable under English Channel. Cable will link 275-kv British grid with 225-kv French system.

"Business is good in Iowa," Iowa P&L's Pres N. Bernard Gussett told New York Society of Security Analysts last week. He thought business would continue at present levels and improve under the influence of population growth and other factors.

Management promotions . . . Richard L. Fite, Jr, rises to VP at Lynn Gas & Electric . . . Southern Nevada Power VP's E. F. Johnson.

Power Output—Up 1.8% (Week ending Mar. 15), Kwhr 11,860,000,000



Per Cent Change From Previous Year

	Mar. 1	Mar. 8	Mar. 15
Total U.S.	+0.1	−0.6	+1.8
New Eng.	+2.2	+0.8	+1.9
Mid. Atlant.	+0.1	−0.9	+1.7
Cent. Ind.	−3.1	−3.0	−1.1
West Cent.	+0.8	+2.0	+2.5
Southeast	+0.5	−2.2	+3.3
South Cent.	+2.0	+1.6	+1.9
Rocky Mount.	+6.0	+3.1	+6.5
Pacific			
NW	+2.3	+4.2	+1.9
SW	+2.0	+2.6	+4.5

Seasonally Adjusted Index 229.4

Week Ago 227.6 Year Ago 224.0

Atomic Energy Commission requirements—1,050,000,000 Kwhr (Electrical World estimate). Excluding AEC, output increase was 3.0%.

EVENTS ▶ **An old rival of electric utilities arms itself for a new battle** with its latest weapon, otherwise known as the Zinder Report. Aimed at capturing the expanding multiple housing market, the report makes some interesting comparisons between all-electric and all-gas operating service costs (p 66).

WASHINGTON ▶ **Report on electric companies' use of fast tax write-offs is released** by Kefauver's Senate Judiciary Committee . . . Idaho Power claims an unfavorable Oregon Water Resources Board decision won't affect its financing or construction of Snake River dams (p 70).

RIGHT OF WAY ▶ **Why is it imperative to acquire future right-of-way sites today?** And how, despite rising costs of obtaining space, can an R/W man capitalize on existing savings potentials? These and other developments facing the nation's electric utilities came in for close probing at EW's recent Right of Way Meeting in Chicago (p 71).

Electric utilities wrestle with rising costs of right-of-way, solving problems in many ways. There's a trend to earlier acquisition of R/W's and construction sites, and it looks like more condemnations are in the cards. A few companies have made studies to determine how much the value of adjacent land goes down when transmission towers go up. The answer—values don't go down at all! Here are the highlights of EW's latest survey of right-of-way practices from 76 utilities from coast to coast (p 105).

To clear a right-of-way through a thick barrier of pecan trees, Community PS crews use a cutter mounted on a crawler tractor (p 78).

ATOMIC PROGRESS ▶ **Shippingport's initial tests, revealing features of shutdown,** startup, and load changing operations, came in for close attention at PEA's recent System Operation Meeting. Delegates also hear of the aqueous homogenous reactor's four main problems—catalyst reaction in the gas recombination system, ionic stress-corrosion cracking of stainless steel, handling of slurry, and hydraulic characteristics in the pressure vessel (p 74).

TRANSMISSION ▶ **Lake Champlain's New York and Vermont shores will soon be linked** by a 9,000-ft, 115-kv submarine cable. Construction will start this spring on the low-pressure-oil, self-contained, single-conductor facility. An adjunct to the St. Lawrence project, it will deliver 100,000 kw of firm power to Vermont; 40,000 kw to Plattsburgh, N. Y. (p 75).

An adjustable aluminum clamp, just developed by Carolina P&L, grounds lines safely while crews work on lines or equipment (p 78).

METERING ▶ **Florida P&L prevents broken glass injuries to its men** and damage to meters with its newly developed plastic protector for holding socket-type meters during installation and removal (p 78).

SYSTEM PLANNING ▸ **What are the criteria for determining system transient stability?** According to two Westinghouse engineers, three reliable measures of stability are severity and type of the assumed disturbance; operation of protective equipment; and system conditions at time of fault. For their analysis of a system's transient performance and their reasons for constant evaluation of these criteria, see p 80.

INDUSTRIAL ▸ **By varying motor terminal voltage, you can obtain speed control** with low horsepower, high-slip induction motors. What's more, recent Brookhaven National Lab tests prove that this relatively inexpensive operation has no adverse effects on motor stability (p 77).

A meat processing firm takes the fire out of its smoking operations by converting the smoking and curing house to an all-electric installation. Strip heaters, thermostatically controlled, assure exact temperatures needed for tenderizing . . . Plummeting maintenance costs and increased production have convinced a pole and piling concern they did the right thing by switching from diesel power to electric drive on a pole peeling machine (p 102).

SELLING ▸ **West Penn's new WHALE of a deal makes a big hit** with employees. Aimed at boosting electrical living, the WHALE plan (Wiring, Heating, Appliances, and Lighting for Employees) provides low-interest loans to company people to facilitate their direct cash purchases . . . In a drive to reduce the dangers at railroad crossings, Houston Lighting & Power inaugurates new lighting system for hazardous areas (p 100).

MANUFACTURERS ▸ **Now en route to Japan is a 330,000-lb boiler drum,** reportedly the largest and heaviest ever exported from the U. S. Measuring 67 ft long and about 8 ft in diameter, the Babcock & Wilcox unit will serve a 175-Mw turbine generator . . . Blaw-Knox designs and makes 110 towers 115-ft high for Philadelphia Electric (p 87) . . . An aluminum transformer tank and structural parts are features of the 7,500-kva trailer-mounted substation shipped to Tampa Electric (p 88).

NEW EQUIPMENT ▸ **Three transformers can be installed in just a half hour,** using a new 42-lb portable hoist. Its two sections can be assembled easily atop a pole . . . Now on the market is an expanded aluminum cable trough whose light weight simplifies installation. It comes in a variety of standard fittings (p 90).

PEOPLE ▸ **Tampa Electric's newly elected vice-presidents are** C. H. Schwaner, who'll direct finance, and M. T. Anthony, VP-sales . . . Peter C. Dirksen is new VP-general manager at New Bedford Gas & Edison Light . . . B. E. Lowe rises to Sierra Pacific Power's vice president and assistant to the president (p 109) . . . Benjamin Electric ups R. J. Mors and R. F. Hurley (p 112).

Every executive knows that meetings don't run themselves. But they can easily run you and your organization if you let them. How to avoid this is the subject of a new book entitled, **How to Run Better Meetings.** Attention to details is the secret of a successful meeting. If you are going to have a good meeting you must: Plan, organize, delegate and then check and recheck the details. A simple oversight like failing to have adequate facilities to check coats and hats near the meeting room can ruin your show. Most of the author's suggestions are just a matter of common sense but it is nice to have them all together in one neat package **How to Run Better Meetings. By E. J. Hegarity. Published by McGraw-Hill Book Co, 330 W 42nd St, New York 36, N. Y. 312 pages. Price $4.95.**

With 95% of the farms electrified, some people say that the REA is finished. Loans, they say, should taper off and co-op expansion cease. This is no more true of the electric co-op than it is of the electric company systems. Each has a continuing responsibility to meet all demands for service and to render dependable service in its area. Co-ops have proved to be effective in supplying rural area service.— **David A. Hamil, REA Administrator. Public Utilities Fortnightly, Feb. 27, 1958.**

Random sampling of work done by engineers can determine how much time is spent in "non-engineering" activities. Results can be used to channel routine work to technicians and other specialists and "discover" more time for professional engineering.—**G. E. Feldman, Allis-Chalmers Electrical Review, 4th Quarter, 1957.**

TECHNICAL NOTES

Polyethylene cable sheaths are improved by specifying polyethylene of higher molecular weight. Lighter molecular-weight polyethylene is susceptible to brittleness resulting from complex stresses possible in handling cable during installation.

Development of nuclear reactor simulators will cut the cost of training nuclear power plant operators. Equipped with analog computers, they will reproduce reactor instrument readings, reactions, and operations.

Minor changes in generator outage rate have little effect on the probability of loss of load; therefore the outage rate to be chosen for generating units is not critical as long as estimates are reasonable.

GATE HOUSE at entrance to Indian Lake Estates, country club community, with the professionally styled L-M Ovalite (Line 2A) mercury vapor luminaires mounted on double upsweep arms to light the dual-lane avenues. These provide uniform illumination of 4.2 footcandles on the roadways. Lights are turned on and off automatically by L-M photoelectric relays.

L-M Luminaires Light Florida's Beautiful Indian Lake Estates

High in the lake and ridge section of Florida, in the area around Lake Wales, is located a new private city, Indian Lake Estates. This is a multi-million dollar development, an exclusive country club community, providing exceptional beauty and outstanding recreational facilities for residents.

Lighting the palm-lined, dual-lane avenues are L-M Ovalite (Line 2A) mercury vapor luminaires. These luminaires, mounted on metal poles at 30 feet, have dual 8-foot upsweep arms. They carry 20,000 lumen lamps and provide uniform illumination of 4.2 footcandles on the roadways. Underground 240-volt wiring serves the luminaires, which are controlled by photoelectric relays.

In addition, a 1,100-foot private pier is lighted with L-M's famous Suburbanaire (Line 2B) open type units containing 175-watt mercury lamps and ballast. They are spaced at approximately 100-foot intervals along the pier and provide 2.0 footcandles of illumination.

Ovalite An Efficient Light Source

The Line 2A luminaires have a high coefficient of utilization. Additional advantages include: choice of Type II, III, or IV light distribution patterns, by simply changing lamps or socket settings; many features for safety and easy servicing, including L-M's exclusive "service-safe" socket; choice of series or multiple service.

Get Complete Information

L-M provides a complete, highly styled lighting line of incandescent, mercury vapor, and fluorescent units, with excellent application engineering help for utilities, municipalities, consultants and subdividers. Ask the L-M Field Engineer or Lighting Engineer about L-M outdoor lighting equipment. Or write Line Material Industries, Milwaukee 1, Wis. In Canada: Canadian Line Materials, Ltd., Toronto 13, Ontario.

McGRAW EDISON

331-R

LINE MATERIAL Industries Outdoor Lighting

McGRAW-EDISON COMPANY

L-M's "HDO" open-type cutouts provide greater system reliability. The bird-proof design, rugged construction, and high interrupting capacity built into the cutout assure long, trouble-free service.

How L-M "HDO" Open-Type Cutouts Handle Both High and Low Faults

L-M's controlled double-venting principle provides positive pressure control—an outstanding advance in fuse cutout design.

by **M. L. FENNIG**
Sales Application Engineer,
Protective Equipment.
Line Material Industries

Fuse cutout design has always been something of a compromise. To assure expulsion of arcs from low-amperage faults, the tube must provide small volume to build ample pressure. Yet this same tube is subject to sudden rupture from the rapid development of large gas volumes from high-amperage arcs. L-M's controlled double-venting principle provides the best solution to this problem known at the present time.

Positive Pressure Control

A unique feature of L-M's "HDO" cutout is the pressure-controlled double-venting cap. On low-amperage faults, gases are vented from the bottom of the tube only. This allows sufficient pressure to build up in the tube to assure consistent, reliable arc interruption of faults of the smallest magnitude.

On high-amperage faults, where pressure relief is needed, the diaphragm in the heavy-duty cap opens at the top to allow double venting. The double venting reduces the stress on the cutout, eliminating the possibility of bursting the tube on high-amperage faults. This assures dependable operation, and greater safety for the lineman. Gases from the top are vented vertically to avoid gases from the bottom. This minimizes possibility of contact flashover.

L-M's "HDO" cutouts are strong, durable and easy to operate. They provide the greatest system reliability and lowest operating and maintenance cost of any cutout on the market today. Here's why.

Lower Resistance Path

All current-carrying parts are made of heavy-duty solid copper or copper alloy and are silver-plated to assure cool operation even after many years of service. In addition, the "HDO" has a minimum number of current-interchange points in the circuit, from line lead to the load lead. This provides ample capacity without overheating for years to come.

Greater Resistance to Corrosion

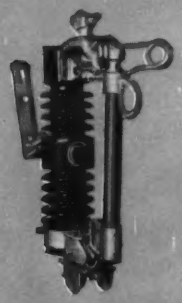
L-M uses high-strength, low-alloy corrosion-resistant steel, such as Cor-Ten, for all non-current-carrying parts, except the hanger. Cor-Ten steel has a yield point at least 1½ times that of structural steel and about twice that of mild carbon steel. Its ability to withstand atmospheric corrosion is 4 to 6 times greater than mild steel.

The results of a 16-year test, shown in the curves, prove the superior corrosion resistance of the low-alloy corrosion-resistant steel hardware furnished with L-M's "HDO" cutout.

Other Outstanding Features

- The "HDO" offers many other desirable features:
- Top contacts and center hanger mounting have through-bolts with insulated heads to provide complete bird-proof protection.

LINE MATERIAL Industries
McGRAW-EDISON COMPANY



Distribution Class Single Insulator Type

L-M's standard mounting "HDO" cutouts are rugged, easy to operate with hook-stick. All current-carrying parts are silver-plated to assure cool operation.

Two Insulator Type

Distribution post insulator mounting of L-M's "HDO" cutouts provides additional creepage distance for applications in industrial and coastal areas.

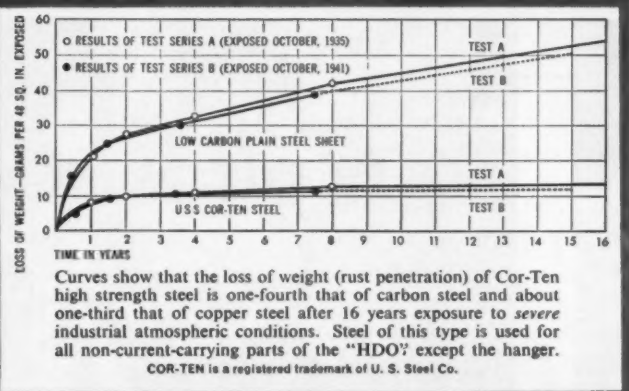
Complete Line of Open-Type Cutouts from 5.2 kv to 27 kv

Power Class

Substation mounting is also available. L-M's "HDO" cutouts provide high interrupting capacity, economical fuse replacement, easy operation with a hook-stick and long life.

Load Break

Easy pulling action of interchangeable load-break cartridge will break the link. Arc interruption is completed inside the tube, assuring fast, safe switching of either inductive or capacitive load currents. Available in 5.2, 7.8, 15 and 27 kv ratings.



Curves show that the loss of weight (rust penetration) of Cor-Ten high strength steel is one-fourth that of carbon steel and about one-third that of copper steel after 16 years exposure to *severe* industrial atmospheric conditions. Steel of this type is used for all non-current-carrying parts of the "HDO" except the hanger.

COR-TEN is a registered trademark of U. S. Steel Co.

SIZES AND RATINGS

Cartridges	Interrupting Capacities, Amperes 5.2 KV	7.8 KV	15 KV	27 KV
Normal-Duty Single Venting (Solid Cap)	3000 A.	3000 A.	2000 A.	1200 A.
Heavy-Duty Double Venting (Heavy-Duty Cap)	6000	6000	4000	4000
Heavy-Duty Single Venting (Solid Cap)	5000	5000	4000	
Extra-Heavy-Duty Double Venting (Heavy-Duty Cap)	10000	10000	8000	

- All cartridges are designed for easy hook-stick removal and replacement.
- Top contacts are husky, hard-drawn copper, silver-plated. They serve as guides so the tube cannot miss top contacts.
- Cartridge is firmly anchored; the tube cannot move upward, even when it is accidentally closed in on a fault, within its rating.
- Cutout interrupts any fault current, from minimum melting of link to maximum interrupting capacity of cutout, *with any size link*.

Complete Line of Cutouts

L-M offers a complete line of cutouts in 5.2, 7.8, 15 and 27 kv classes, with a full line of fuse cartridges in normal, heavy, and extra heavy-duty interrupting rating, switch blade, and interchangeable load-break cartridges. All cartridges (except the 27 kv) use standard 20-inch distribution fuse links.

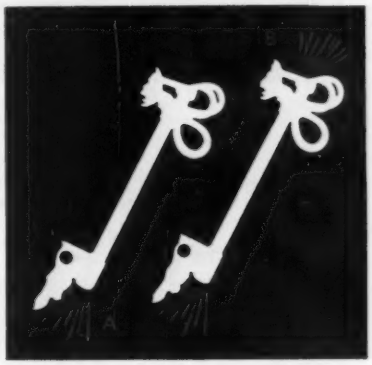
Interchangeable Load-Break Cartridge

Line Material's "HDO" open-type cutout has optional interchangeable load-break cartridges available in each voltage class and interrupting rating.

A pulling force of less than 30 pounds is required to break the largest size link. The cartridge is designed to interrupt all capacitive and inductive loads up through 100 amperes and to completely extinguish the load current in the tube. With L-M's simple load-break device you can switch loads or sectionalize distribution circuits quickly and easily with very little increase in your cutout investment.

Get Complete Information

Ask the L-M Field Engineer for bulletins and complete information about L-M's full line of open and enclosed fuse cutouts and other protective equipment. Or write Line Material Industries, Milwaukee 1, Wisconsin. In Canada: Canadian Line Materials, Ltd., Toronto 13, Ontario.



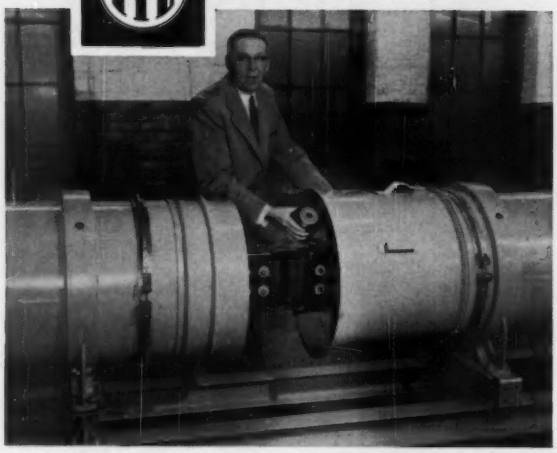
How Double Venting Controls Pressure

On low-amperage faults, ample pressure is provided to insure fast arc extinction, by single venting at the bottom of tube, *A*.

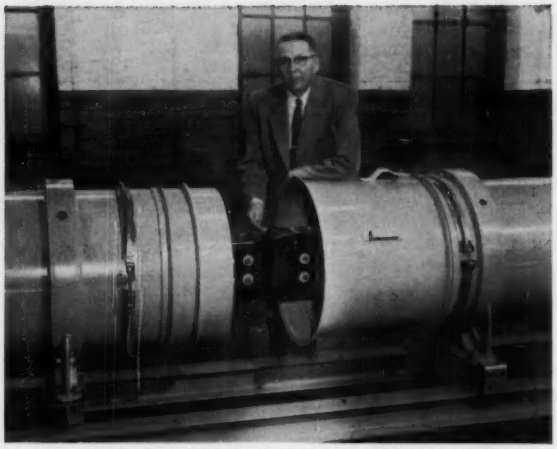
On high-amperage faults, heavy-duty cap at top (*B*) opens so that pressure is vented at both top and bottom of tube, providing greater safety by eliminating tube rupture. Note that the gases from the top are vented vertically—not horizontally. This eliminates danger of contact flashover.

fuse cutouts and fuse links McGRAW EDISON

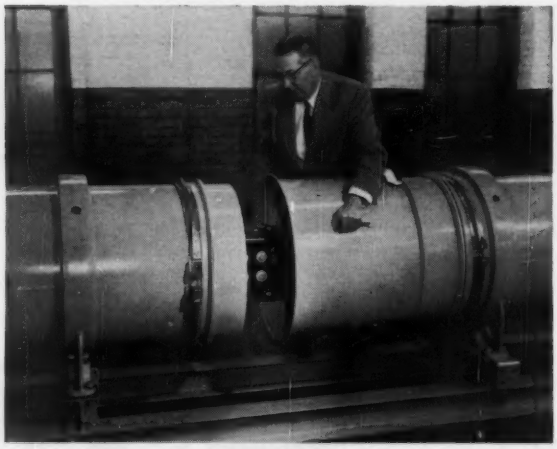
ISOLATED PHASE BUS



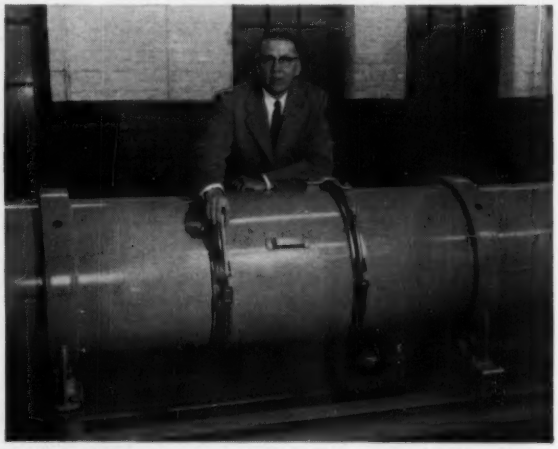
Sliding cover in open position. Connectors are easily accessible for assembly and maintenance. High-strength wet porcelain insulators, mounted in compression, are easily reached for inspection and removal.



Connectors can be either bolted or field welded. When bolted, Belleville washers are used to maintain adequate contact pressure. Conductors are either copper or aluminum. All copper connections are silver plated.



Sliding cover in partially closed position. Flanged cover, flanged rings, lifetime silicone rubber gaskets and clamping bands provide a positive seal, prevent dust accumulation, simplify opening and closing.



Sliding cover in closed position. Closure requires only two 1-piece lifetime silicone rubber gaskets—easy to place and remove. Simple, powerful V-clamp band exerts pressure uniformly around the flanged rings.

How I-T-E Sliding Covers Reduce Installation and Inspection Time

Sliding covers, well located, to facilitate joint makeup and inspection are one of the many money-saving advantages of I-T-E Isolated Phase Bus. Others include the most simple and efficient of designs; greatest installation flexibility; light weight to save installation time, labor cost, and structural steel; quick, reliable engineering; and excellent delivery.

I-T-E Isolated Phase Bus is available in ratings through 138 kv, through 20,000 amp. Self and forced-air cooled. Send today for Bulletins 10004-A and 10004-B, giving complete information. I-T-E Circuit Breaker Company, Switchgear Division, 19th & Hamilton Sts., Philadelphia 30, Pa. In Canada: Eastern Power Devices Ltd., Toronto, Ontario.

I-T-E CIRCUIT BREAKER COMPANY
PHILADELPHIA, PENNSYLVANIA

Handles the Complete Range of Fault Currents!...

Heart of the versatile Faultmaster Fuse Cutout is the small bore, fibre-glass reinforced, single vented fuse tube. This minimum inner diameter fuse tube of maximum mechanical strength assures positive expulsion action necessary for the safe, sure, instantaneous arc interruption.

The Hubbard *Faultmaster* Fuse Cutout will handle faults over the entire operating range from minimum to maximum available fault current. There is no need to constantly check available fault current values at many different points as the system is expanded.

Silver plated contacts, long life contact springs, positive closure, transformer type terminals, sleet, animal and bird proofing are but a few of the many outstanding features of the *Faultmaster* that assure enduring service. Mechanical load break attachment can be furnished on order.

Your Hubbard Representative will be glad to supply you with full information. Call him today—or write for Bulletin 756.

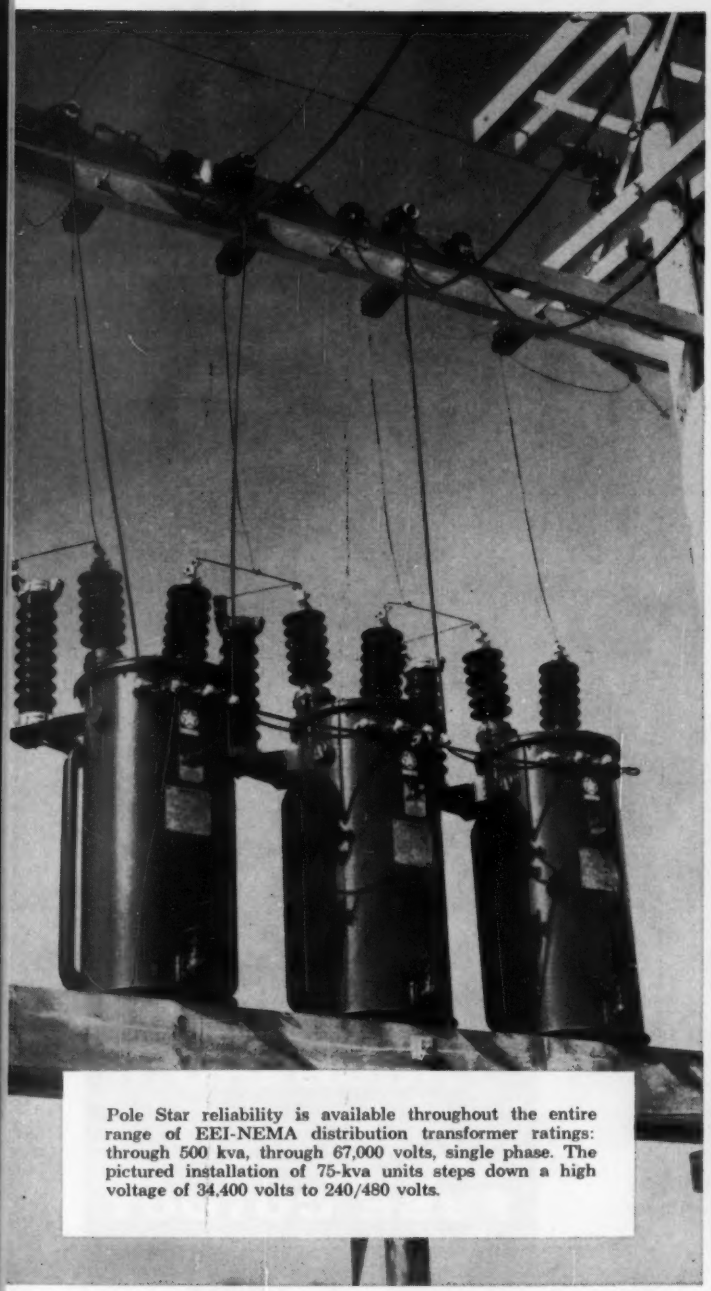
HUBBARD *Faultmaster* FUSE CUTOUT

HUBBARD AND COMPANY • 6301 BUTLER ST., PITTSBURGH 1, PA.

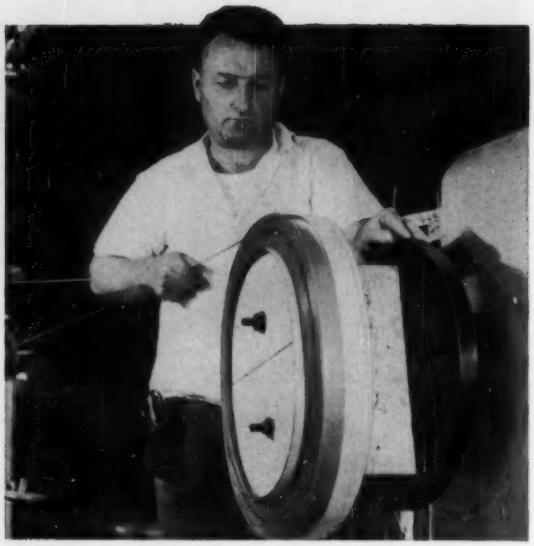
CHICAGO 50, ILLINOIS • OAKLAND 8, CALIFORNIA • PLANO, TEXAS

Electrically, Mechanically... POLE STAR

the ruggedness that's needed

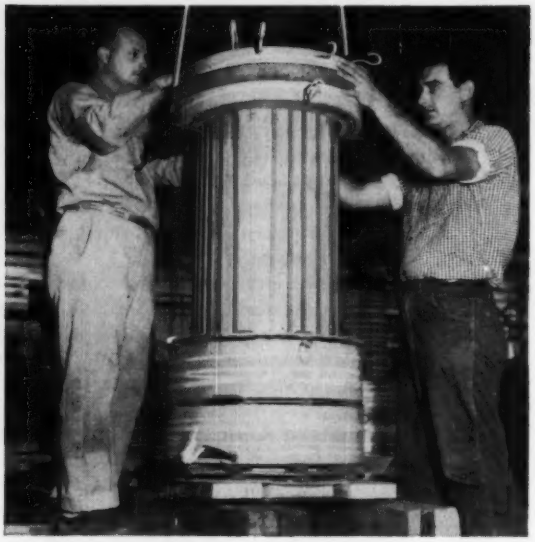


Pole Star reliability is available throughout the entire range of EEI-NEMA distribution transformer ratings: through 500 kva, through 67,000 volts, single phase. The pictured installation of 75-kva units steps down a high voltage of 34,400 volts to 240/480 volts.



Above: Sections of Pole Star high voltage coils are wound on precise molds to assure uniform dimensions. Maintenance of proper tension on the wire, plus the use of thin layer insulation, produces coil sections that are completely firm, without "sponginess."

Below: High voltage coil sections are snugly fitted over the layer-wound low voltage coil. A free flow of oil for cooling is assured by the liberal use of spacers—between the high voltage sections as well as between the high and low voltage coils.



POLE STAR

PENNSYLVANIA POLE STAR

SECTIONAL COILS have

for high voltage applications

To obtain uniform distribution of voltage stresses throughout the winding is one of the principal reasons for using sectional high voltage coils in Pole Star distribution transformers rated 34.5 kv and higher. In addition to providing this basic advantage—which results in high resistance to lightning and other voltage surges of impulse magnitude—Pole Star sectional coils feature several Pennsylvania Transformer developments that play an important part in the *sustained performance* of Pole Stars under the most rigorous conditions.

Pole Star Bonding Process Provides Exceptional Strength

Like all Pole Star coils, high voltage sections are wound on precise molds to assure uniform dimensions. By carefully maintaining proper tension on the wire during the winding process, and by taking full advantage of the thinner layer insulation made possible by the Pole Star design, Pennsylvania Transformer craftsmen produce coil sections that are completely firm, with no "sponginess."

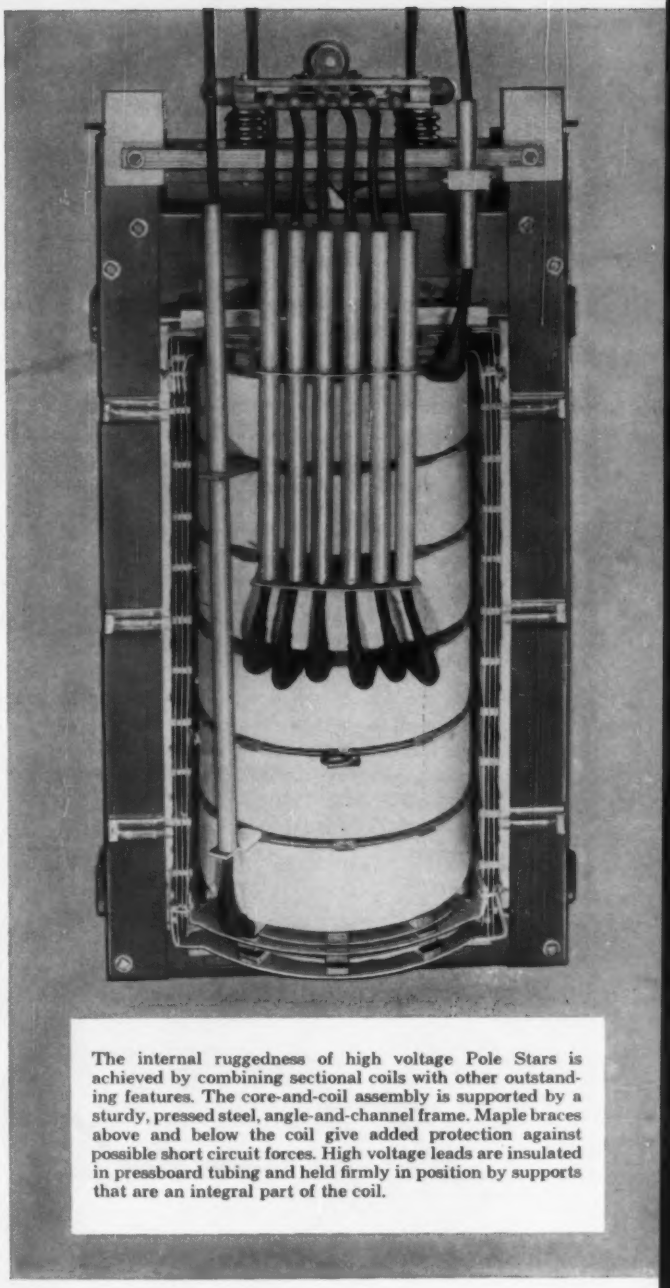
After high voltage sections are snugly fitted over the layer-wound low voltage windings, the completed coil undergoes a curing and drying cycle that firmly bonds each turn of wire to the adjacent insulation, by first softening and then polymerizing a special adhesive with which the kraft layer insulation is pre-coated. This procedure produces a coil with exceptional resistance to short circuit . . . and also assures high electrical strength by retaining the pliability of insulation and permitting the penetration of oil throughout the coil.

Crepe Insulating Collars Give Extra Margin of Protection

A primary reason for the compactness of Pole Star high voltage sectional coils—and for the space-saving, weight-saving transformers they make possible—is the efficient use of the best available insulating materials. For example, the crepe paper used with kraft insulation is folded over at the ends of the coil. This creates an insulating "collar" that achieves maximum electrical strength without adding unnecessarily to coil size. The additional puncture strength and creepage path this collar provides help create an impulse strength that liberally exceeds ASA-NEMA standard impulse levels.

These features and advantages all add up to the *ruggedness* that is needed for high voltage distribution transformer installations. For more Pole Star facts—or for a quotation on specific units—contact Pennsylvania Transformer Division, McGraw-Edison Company, Canonsburg, Pa.

McGRAW EDISON



The internal ruggedness of high voltage Pole Stars is achieved by combining sectional coils with other outstanding features. The core-and-coil assembly is supported by a sturdy, pressed steel, angle-and-channel frame. Maple braces above and below the coil give added protection against possible short circuit forces. High voltage leads are insulated in pressboard tubing and held firmly in position by supports that are an integral part of the coil.

DISTRIBUTION TRANSFORMERS pt

GUY-GRIP dead-ends...

the modern twist in guying

The picture comparison makes GUY-GRIP dead-end benefits obvious.

1. THE ASSEMBLY LOOKS BETTER...
slim, modern GUY-GRIP dead-ends, free from bolts, give your guying jobs a finished, craftsmanlike appearance.

2. YOU SAVE *HOURS* OF COSTLY TIME...
takes only a minute to install a GUY-GRIP dead-end — about the same time spent in securing one nut and bolt.

3. YOU ELIMINATE ALL TOOLS...
wrenches, pliers, and other tools are completely unnecessary in applying GUY-GRIP dead-ends. The operation is done entirely by hand.

4. ASSURES POSITIVE GRIP...
under all field conditions, whether the guy is relaxed or under tension. Once the legs of the GUY-GRIP dead-end are entirely applied to the strand, you *know* the assembly is complete and permanent.

5. RESISTS STRAINS AND WEATHER...
GUY-GRIP dead-ends can take an unbelievable beating. Tension, impact, temperature extremes . . . whatever force is exerted against GUY-GRIP dead-ends, they withstand the most extreme conditions, never relinquishing a single ounce of their gripping power.

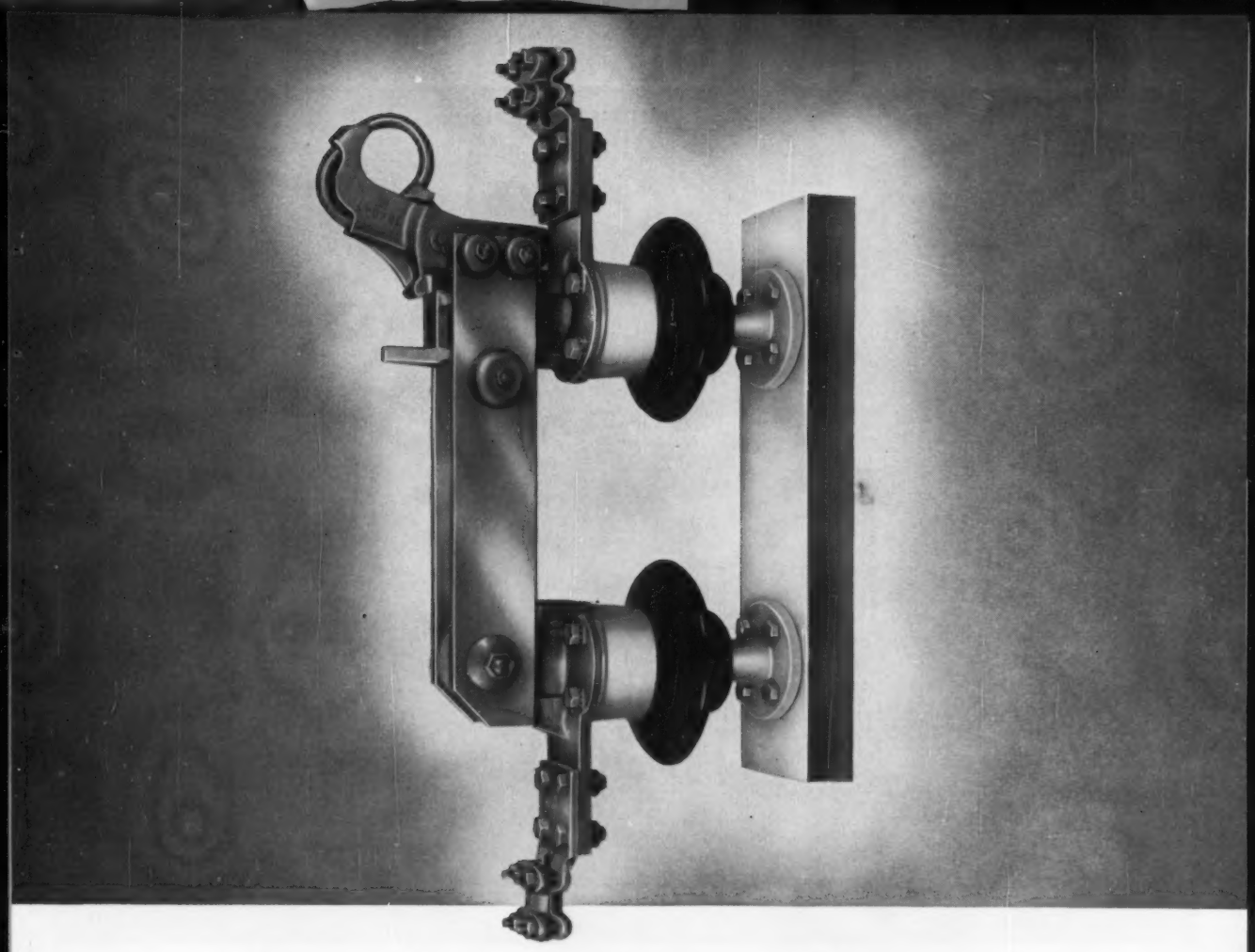
These are only a few of the many reasons why you might want to try the modern twist in guying. Write for more information: Preformed Line Products Company, 5349 St. Clair Avenue, Cleveland 3, Ohio. Cable Address: Preformed-Cleveland.

PLP 10 YEARS OF Power Line Progress

You can look up to

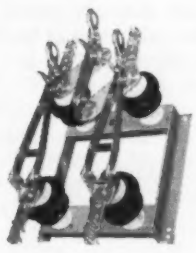
Preformed

Made in accordance with or for use under U. S. Patent No. 2,761,273; other patents issued and pending.



There is an Important Difference in this Southern States Disconnect

TYPE PBO-R



This regulator by-pass switch offers a compact unit that provides disconnecting means needed to by-pass and isolate voltage regulators. Available in ratings of 7.5 — 15 kv — 400, 600, and 1200 amps.

All hookstick-operated disconnects are simple devices. There are no intricate mechanisms — nothing complicated in their design or construction.

Certain highly desired features are fairly well standardized on disconnects being marketed today: positive latching of the blade in its closed position; a blade pryout; guides to position the blade when closing; and high pressure line contacts.

Yet there is an important difference in disconnects!

You can't see it feature by feature. It is apparent only when you take a good, studious look at the complete unit. For then you see how all of the features blend together to give you a sturdy, rugged and highly dependable piece of equipment.

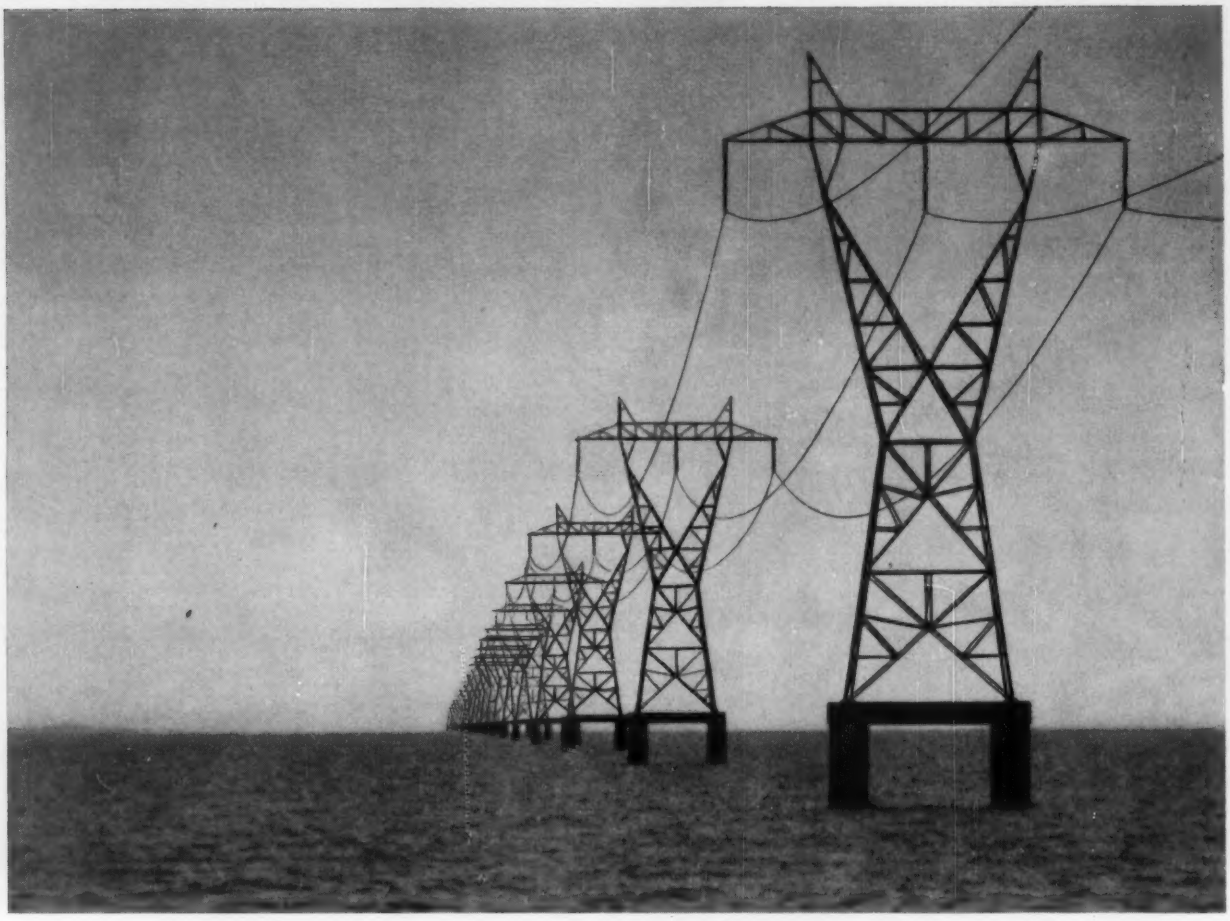
Take a look at the Southern States PBO Disconnect illustrated above and you'll see what we mean.

For the full story, see your Southern States representative, or write for Bulletin 55 PBO.

LIVE BETTER ELECTRICALLY

SOUTHERN STATES
EQUIPMENT CORP.
HAMPTON, GEORGIA

IN CANADA: Dominion Cutout Co., Ltd., Toronto



Alcoa's Tailor-Made ACSR Helped

Louisiana P & L's 15 miles of 230-kv, 1.457-inch-diameter ACSR is the second largest diameter installation of non-expanded ACSR in the U.S. Like the largest, it was designed and manufactured by Alcoa.

Louisiana Power & Light Corporation found that running a transmission line across one of the world's stormiest lakes was a job requiring de Lesseps-like engineering, painstaking planning and the utmost dependability from every single piece of equipment. But they also found help from two sources—Alcoa ACSR, specially designed and manufactured for this application, and Alcoa field advisors.

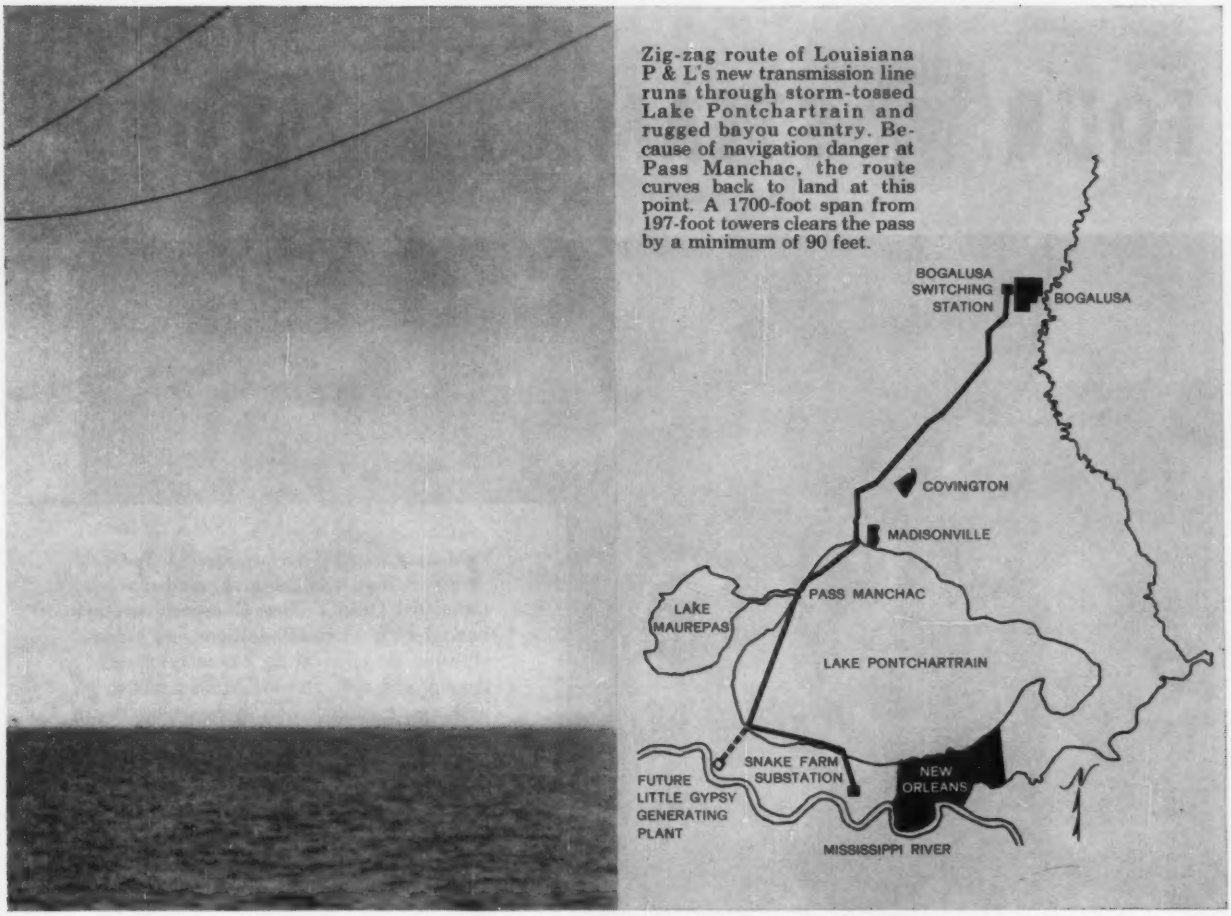
Across-the-Lake Route

The problem was to move power from the Snake Farm substation, five miles from the southern shore of Lake Pontchartrain, to the Bogalusa substation, 65 miles to the north. A combination of marshes and bayous made it impossible to follow an around-the-lake route. The alternative was to go through the lake. But that also had its problems. The lake bed is muck, which is a poor foundation for transmission towers. This made it necessary to dig down to the layers of Pleistocene clay for a sound foundation.

Concrete piles, 54 inches in diameter, 48 to 96 feet long, were specially made and installed as foundations. Tower legs were set in concrete caps 12 feet wide. The towers themselves are 75 feet above the foundation. The conductor clears the lake by a minimum of 40 feet, while spans on the lake are from 850 to 950 feet. Most of the line is single circuit and built to operate at 230 kv, although initially it will be in 115-kv service.

Wind Aggravates Problems

To stand up under these rugged conditions, where there is an average of 75 storm days per year and constant corrosion from salt water, Louisiana Power & Light chose dependable Alcoa ACSR. And, because ice loading is no problem, Alcoa was able to save them money by developing a conductor having a special stranding with less steel but the same electrical capacity. The first 15 miles are 1,468 MCM, 48/7, 1.457 inches in diameter, the second largest nonexpanded ACSR in use in the United States. The rest of the line is 1027.4 MCM, 48/7, 1.220



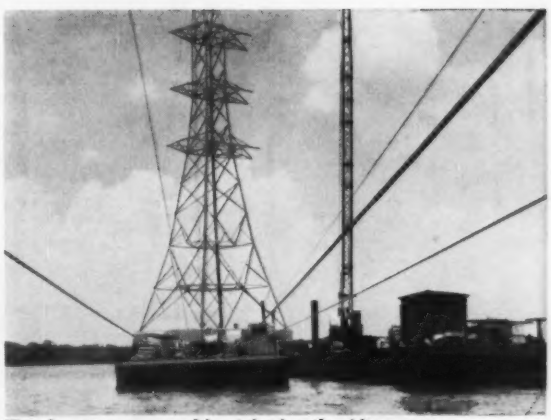
Zig-zag route of Louisiana P & L's new transmission line runs through storm-tossed Lake Pontchartrain and rugged bayou country. Because of navigation danger at Pass Manchac, the route curves back to land at this point. A 1700-foot span from 197-foot towers clears the pass by a minimum of 90 feet.

Win the Battle of Lake Pontchartrain

inches in diameter. Over the lake, the conductor is designed for 25 pounds per square foot of wind pressure at 60 degrees F. Jumpers are run through two-inch aluminum tubes to give added rigidity.

Assisting the contractor and the utility men on the job were Alcoa field advisors Shorty Lowe and Ralph Huston. Their many years of experience with installations in every part of the country helped speed the job to successful completion.

This installation is typical of the extra service and assistance you can expect when you specify Alcoa. Because Alcoa has more experience in conductor application, manufacture and erection, you can count on safe, sure operation. For help with any conductor problem, Alcoa personnel are at your service. Call Alcoa—or write Aluminum Company of America, 2306-C Alcoa Building, Pittsburgh 19, Pennsylvania.



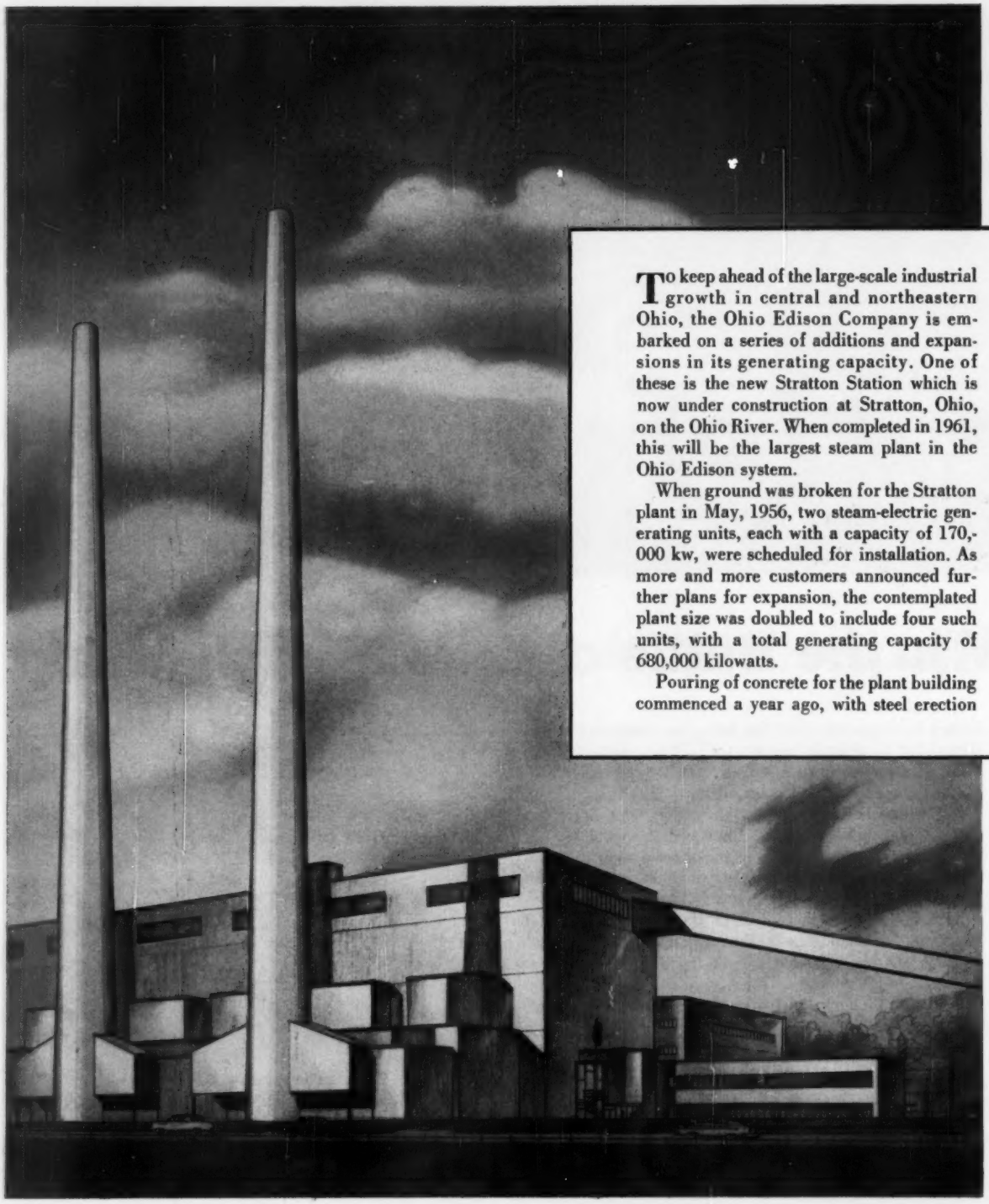
Two barges were used in stringing the Alcoa conductor across Lake Pontchartrain. One carried conductor and accessories, the other suspension insulators and the crane.

ALCOA ALUMINUM
ELECTRICAL CONDUCTORS AND ACCESSORIES

Your Guide to the Best in Aluminum Value

"ALCOA THEATRE"
Exciting Adventure
ALTERNATE MONDAY EVENINGS

At Ohio Edison's
FOUR FW STEAM GENERATORS



To keep ahead of the large-scale industrial growth in central and northeastern Ohio, the Ohio Edison Company is embarked on a series of additions and expansions in its generating capacity. One of these is the new Stratton Station which is now under construction at Stratton, Ohio, on the Ohio River. When completed in 1961, this will be the largest steam plant in the Ohio Edison system.

When ground was broken for the Stratton plant in May, 1956, two steam-electric generating units, each with a capacity of 170,000 kw, were scheduled for installation. As more and more customers announced further plans for expansion, the contemplated plant size was doubled to include four such units, with a total generating capacity of 680,000 kilowatts.

Pouring of concrete for the plant building commenced a year ago, with steel erection

Largest Plant,

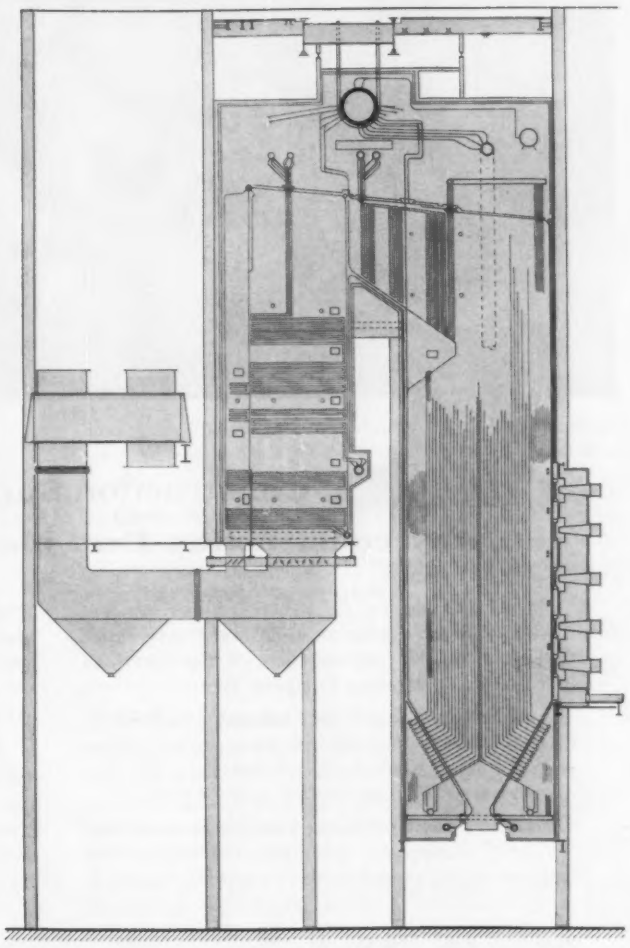
will deliver 5,000,000 lb/hr

New Stratton Station, now under construction, will have capacity of 680,000 kw by 1961 — with four 170,000 kw units, each served by a FW 1,250,000 lb/hr Reheat Steam Generator

beginning last August. The first turbo-generating unit is scheduled to go into service late this year — the second next year, the third in 1960 and the fourth in 1961.

Steam for all units at Stratton Station will be supplied by four Foster Wheeler reheat steam generators with a combined capacity of five million pounds per hour. Each of these FW boilers will have a normal capacity of 1,250,000 lb/hr at a pressure of 2450 psig (2700 psig design) and a temperature of 1050 F at the superheater outlet. The reheat flow will be 1,040,000 lb of steam per hour at 430 psig and 1000 F.

With more than a half-century of experience in steam generation — and the finest modern manufacturing facilities in three large plants — Foster Wheeler welcomes the opportunity to quote on your requirements. *Foster Wheeler Corporation, 666 Fifth Avenue, New York 19, N. Y.*



Architect's conception of the completed Stratton Station plant of Ohio Edison. Ground was broken for the plant in May, 1956. When the last of four units is installed at Stratton Station in 1961, it will have the largest capacity in the Ohio Edison system.

Cross section of reheat steam generator for Ohio Edison's Stratton Station. Four of these units have been ordered for the 680,000-kw plant. Each unit will supply 1,250,000 lb of steam per hour at 2450 lb/sq in. pressure, 1050 F primary steam temperature and 1000 F reheat temperature.

FOSTER WHEELER

NEW YORK • LONDON • PARIS • ST. CATHARINES, ONT.

"Failure here can cost $50,000"

Installing Chase Antimonial Admiralty Tube in condenser of Unit #4 at the Eastlake Plant of The Cleveland Electric Illuminating Company. Unit uses 16,150 Chase tubes totalling 484,500 ft. in length, removes 988 Btu of heat/lb. of steam when condensing 1,046,830 lbs. of steam/hr.

Construction Superintendent reports reasons why construction firm plays it safe with Chase® Tube

Merle C. Anderson, Construction Superintendent for Worthington Corporation when they tubed Unit #4 at the Eastlake Plant of The Cleveland Electric Illuminating Company says:

"Condenser Tube failure can cost up to $50,000, so we have to start out with a top product. Chase Antimonial Admiralty Condenser Tube will give us good, efficient service for over 20 years."

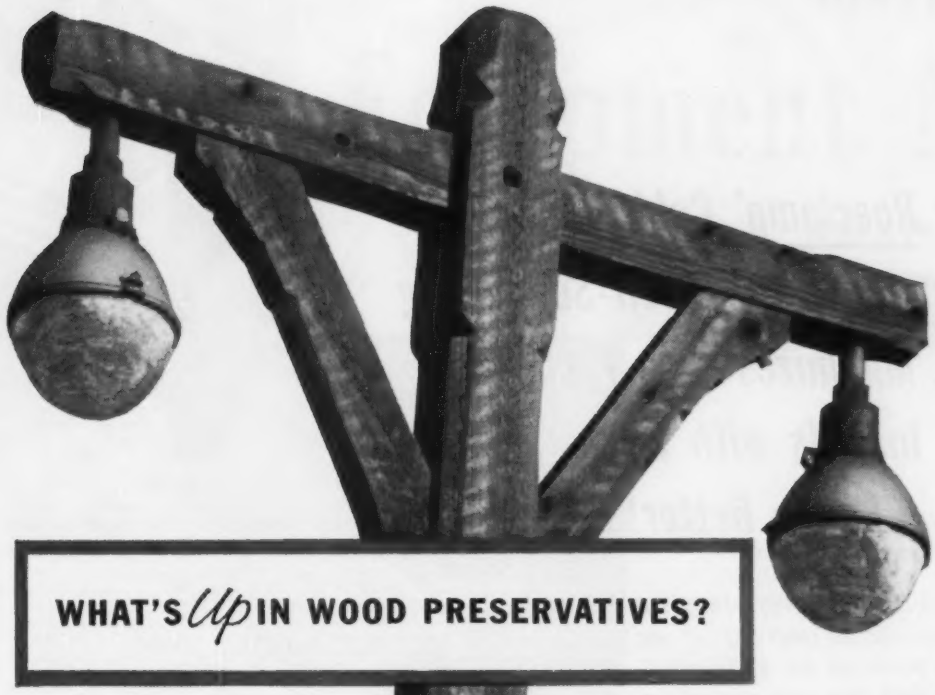
Power plant operators everywhere know that Chase® Antimonial Admiralty Condenser Tube gives longer, more trouble-free service. Reason is its far superior resistance to breakdown caused by corrosion, high temperatures and water-borne impurities. Plus values of Chase Tube include good strength and hardness, high thermal conductivity and resistance to fatigue, wear and abrasion.

It will pay you in better service, less down-time and longer tube life when you specify Chase Antimonial Admiralty Condenser Tube—either for retubing or as original equipment. Talk it over with your nearest Chase Representative—locally or at Waterbury 20, Connecticut.

Chase BRASS & COPPER CO.
WATERBURY 20, CONNECTICUT
SUBSIDIARY OF KENNECOTT COPPER CORPORATION

The Nation's Headquarters for Brass, Copper and Stainless Steel

Atlanta Baltimore Boston Charlotte Chicago Cincinnati Cleveland Dallas Denver Detroit Grand Rapids Houston Indianapolis Kansas City, Mo. Los Angeles Milwaukee Minneapolis Newark New Orleans New York (Maspeth, L. I.) Philadelphia Pittsburgh Providence Rochester St. Louis San Francisco Seattle Waterbury



WHAT'S *Up* IN WOOD PRESERVATIVES?

PENTA TREATMENT!

It's Cleaner, Protects Better And Costs No More

Take your pick of *three* important reasons why you should preserve wood with PENTA treatment! Any *one* of them should cinch the matter.

1. Costs no more – Service records show PENTA treatment gives poles, cross ties and other lumber for exposed structure extra long life. Yet PENTA treatment costs no more than ordinary preservatives.

2. Won't leach out – Because PENTA is an oil-borne rather than water-soluble preservative, it doesn't leach out, leaving wood vulnerable to rot and termites.

3. Clean to handle – Construction and maintenance supervisors know that workmen handle clean wood faster, more efficiently – and with fewer kicks!

Reichhold is a major supplier of PENTA to the wood industry and to wood users. If you haven't done so yet, investigate this modern method of protecting your lumber investments – write for the name of your nearest Reichhold distributor of PENTA.

Creative Chemistry . . . Your Partner in Progress

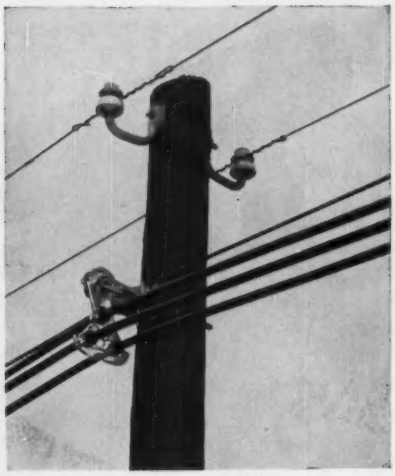
RCI

REICHHOLD

Synthetic Resins • Chemical Colors • Industrial Adhesives • Phenol
Hydrochloric Acid • Formaldehyde • Glycerine • Phthalic Anhydride
Maleic Anhydride • Sebacic Acid • Ortho Phenylphenol • Sodium Sulfite
Pentaerythritol • Pentachlorophenol • Sodium Pentachlorophenol
Sulfuric Acid • Methanol

REICHHOLD CHEMICALS, INC.,
RCI BUILDING, WHITE PLAINS, N.Y.

New Roeclamp Cable System Costs 60% Less than Self-Supporting Cables, Minimizes Tree Problems, Installs with Ease, Looks Better!*



New Roebling Aerial Spaced System with ROECLAMP requires only one foot of clearance through trees! Note improved, compact appearance. No crossarms are needed.

Designed for 5kv systems (2400/4160Y and 4800 v delta) and 8kv systems (4800/8320Y and 7200 v delta), the Roebling Aerial Spaced System actually costs 60% less than conventional self-supporting cables. It provides a neat, compact appearance, improved voltage regulation, higher current-carrying capacity, and positive phase identification.

Up to three conductors can be carried by ROECLAMPS, which are suspended from a strong messenger. The messenger also provides protection against lightning and falling limbs.

Aluminum conductors come in 17 standard sizes and strand constructions, and are made with a greater number of finer strands for extra flexibility. Standard insulation is extruded ROEPLASTIC® P-11R7 (other extruded insulations available). ROECLAMPS come complete with grommets to fit cables and messenger you order.

Ask your Roebling representative to show you the remarkable new ROECLAMP. He'll tell you more, too, about the unusual savings and improvements you can effect with the ROECLAMP System, or write Electrical Wire Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey.

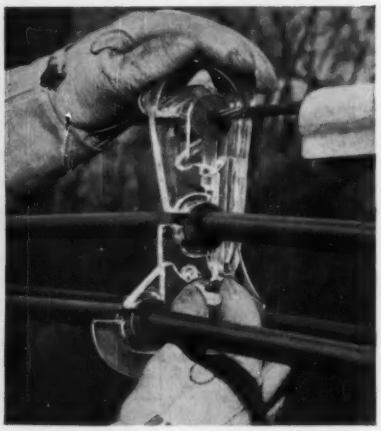
ROEBLING

Branch Offices in Principal Cities
Subsidiary of The Colorado Fuel and Iron Corporation

Roeclamp has unit construction... installs in seconds—without tools!

One motion and ROECLAMP is on messenger and ready to receive conductors. Phase changes and repairs do not necessitate removal of clamp. ROECLAMP comes complete with grommets to fit messenger and conductors you order.

Note how easily conductors drop into place. Installation is measured in seconds, even with "boxing gloves" on. ROECLAMP is Plexiglas†, tests to over 1000-lb. breaking strength, offers outstanding weather resistance, best possible electrical properties.



35 ROECLAMPS are required every 1000 feet. Installation is completed by hand-tightening of nut. Not even a screw driver is required!

*Pat. pending
†Reg. T.M.—Rohm & Haas Co.

DISTRIBUTION

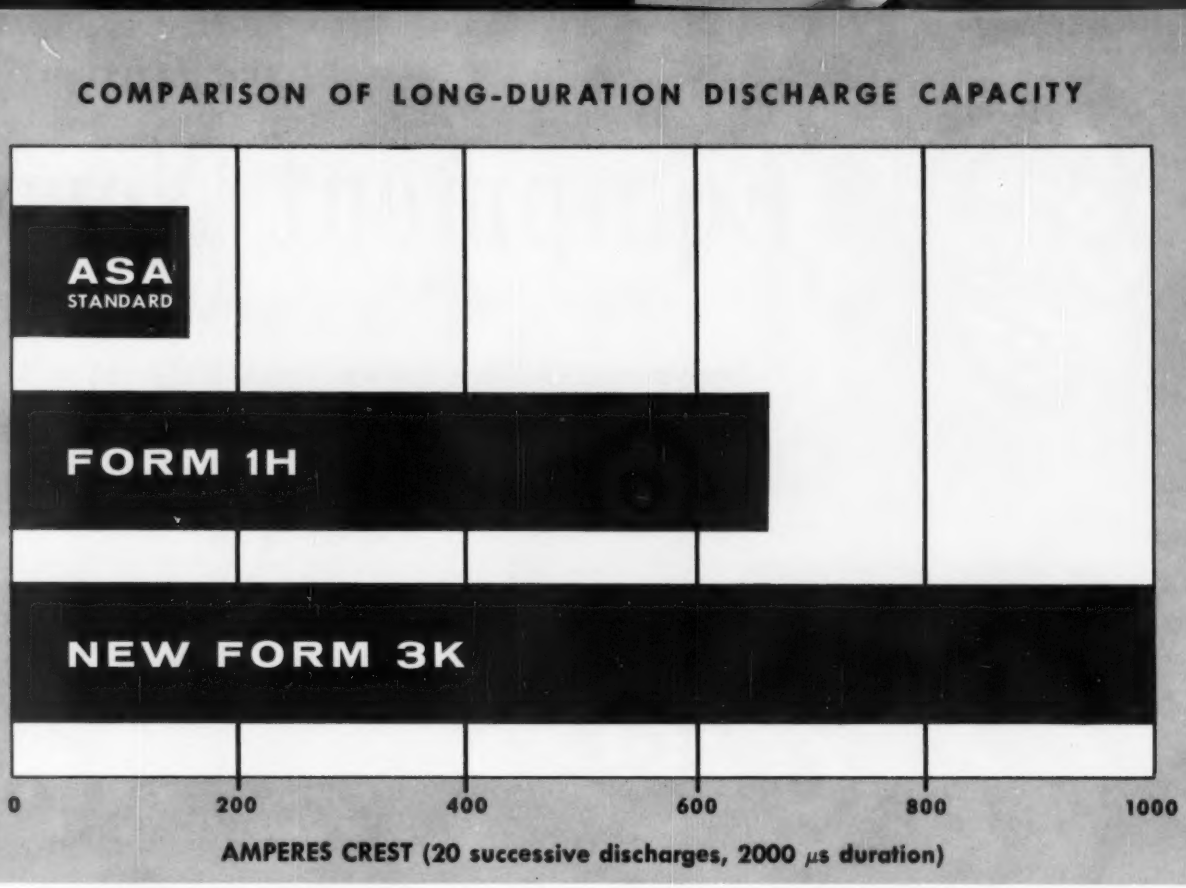
Equipment News

TRANSMISSION

In this issue . . .

- **NEW FORM 3K STATION ARRESTER**
  offers improved characteristics . . . is smaller
- **NEW "VAULT-MASTER" NETWORK TRANSFORMER**
  saves space two ways
- **NEW PANEL RADIATORS ON SUBSTATION TRANSFORMERS**
  reduce height and floor area
- **NEW FUSE CUTOUTS**
  offer increased ratings (open), gas loadbreak (enclosed)

GENERAL ELECTRIC



New improved performance: Long-duration discharge capacity of 1000 amp., 2000 μs wave, is 54% greater than Form 1H arrester and in excess of published values for other reduced-height arresters. Impulse sparkover is the same as that in Form 1H, while IR discharge voltage in new Form 3K has been reduced up to 8% depending on discharge current.

New Form 3K Station Arrester

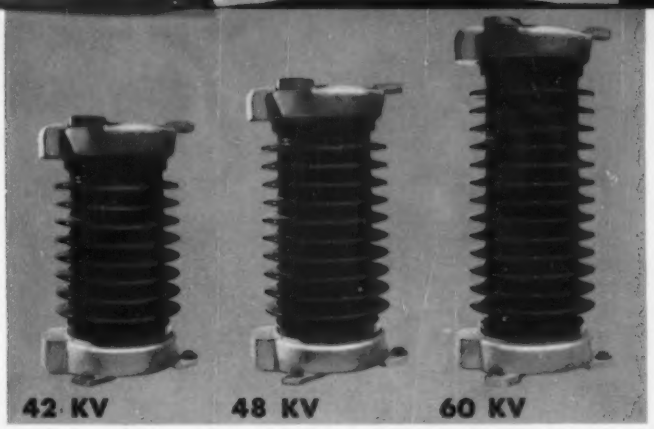
Provides 54% greater long-duration discharge capacity for the protection of expanding high-voltage systems.

Design objective for the "3K" was to produce an all-new station arrester with exceptionally good protective characteristics and high discharge capacity so necessary for high and extra-high voltage (EHV) systems. Newly designed Magne-valve gap and valve elements are arranged ***straight-in-line,*** one on top of the other. This arrangement optimizes both size and performance, combining lower height with 54% greater long-duration discharge capacity. The new "3K" also provides a more direct discharge path, plus greater simplicity and reliability than arresters with internal elements which are physically in parallel and electrically in series.

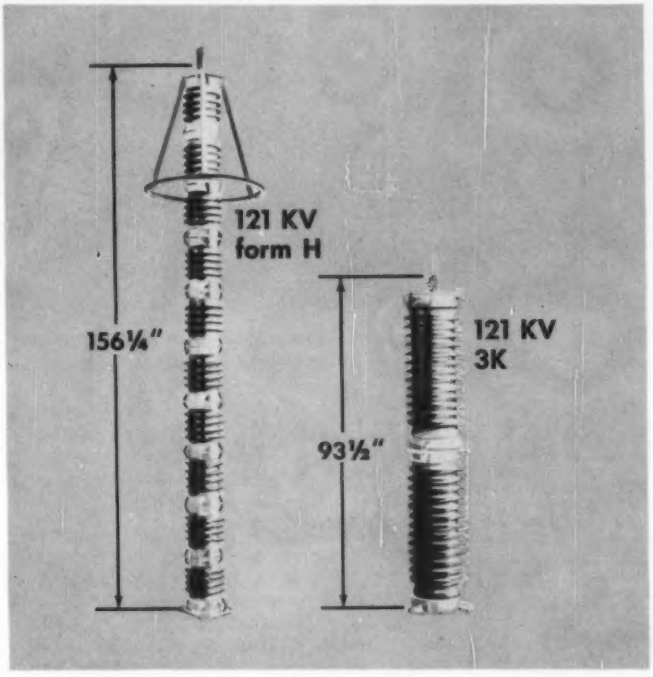
The "3K" is the newest G-E arrester operating on the proven Magne-valve principle. It can be separately base-mounted or suspended in substations, as well as tank-mounted on all makes of power transformers.

For complete information, contact your General Electric Sales Office, or write to General Electric Co., Section 431-74, Schenectady 5, N. Y.

GENERAL ELECTRIC



Flexibility of arrester application is obtained from the three basic unit ratings shown above. The basic arrester units are stacked to obtain a variety of arrester ratings for high and extra-high voltage circuits.



New low height: Form 3K is 40% shorter than the Form 1H arrester.

New Thyrite valve element and magnetic gap unit are exceptionally rugged elements positioned straight-in-line with no objectionable high inductance path. The entire arrester contains no miniaturized elements.

A New Lightning Arrester for Protection in the High Voltage Area

by

E. J. Allen, Supervisor, Station Equipment Sales

This revolutionary new high-voltage self-supporting Magnevalve station arrester is based upon principles of proven performance since G-E engineers pioneered the magnetic gap concept in the mid-1940's. In ratings 85 kv and above, the new Form 3K arrester provides premium characteristics at standard price levels. It supplements but it does not supersede the well-established Form 1H Thyrite* station arrester.

High-voltage system planning dictates the selection of lightning arresters geared not only to the needs of today, but also to system changes during the next 10 or 15 years. The most efficient arrester enables users to confidently adopt the one or two step reduced insulation concept, depending upon operating voltage, with resulting large savings.

In addition, switching-surge duty increases as modern systems increase the length of overhead lines and cables, the size of shunt capacitor banks, and operating voltages. Many systems are even today increasing in all four directions simultaneously! The new Form 3K Thyrite Magnevalve arrester is designed for today's and tomorrow's service requirements on high-voltage systems.

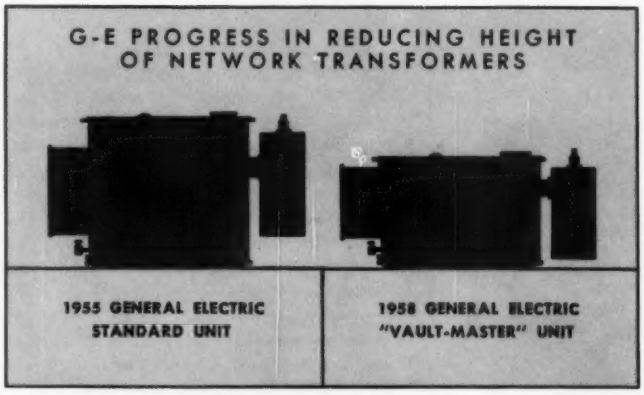
Available in ratings up to 276 kv (or higher if required for special applications) the Form 3K station-type arrester retains the unit construction principle which permits flexibility and economy of application. It facilitates increases or decreases in arrester ratings by simply adding or removing units. Here's a typical example of the versatility of the 3K arrester: when increasing from a 138 kv grounded-neutral system (using an 80%—121 kv arrester) to a 230 kv system (using a 75%—182 kv arrester) it is only necessary to add one 60 kv unit and grading ring. The change from a 121 kv to a 195 kv arrester would involve returning one of the 60 kv units to stock and adding other basic units.

The anti-contamination feature—now built into both the 1H and 3K Thyrite station arresters—combined with an exceptionally liberal creepage distance over the porcelain housing, makes them virtually self-protecting even in the most severely contaminated areas.

*Registered trademark of General Electric Co.

DRAMATIC REDUCTION in size of G-E network transformers is demonstrated by Sales Manager R. T. Morris. 750-kva unit built in 1955, left, is 85 inches high. New 1958 Vault-master 750-kva unit is only 63 inches high—a reduction of 25 per cent.

"Vault-master" network transformer cuts height as much as 25%


G-E PROGRESS IN REDUCING HEIGHT OF NETWORK TRANSFORMERS
1955 GENERAL ELECTRIC STANDARD UNIT
1958 GENERAL ELECTRIC "VAULT-MASTER" UNIT

REDUCTION IN TRANSFORMER HEIGHT is of dubious value if comparable reduction is not made in height of network protector bushings. On new G-E "Vault-master" units, right, throat is lowered up to 15 inches compared with 1955 design, left. This keeps bushings at low height.

GENERAL ELECTRIC

General Electric 15- and 22-kv Vault-master network transformers, now available in all ratings from 300 to 1000 kva, help you save four ways:

1. **Save on Installation**—You can cut construction costs with a smaller vault, and install the unit faster with more "elbow room."

2. **Save on System Expansion**—You can gain extra load-carrying capacity ***without*** enlarging your present vaults. You can usually drop a new 750-kva transformer, for example, into a vault just big enough for an old 500-kva unit.

3. **Save on Maintenance**—The new low height makes it easy to install the transformers off the floor. This is important if your vaults are subject to flooding, or drainage from sewers, or streets sprinkled with salt in winter.

4. **Save on Future Changes**—Low height leaves plenty of space for oil-fuse cutouts, capacitors, protectors, or higher-rated units.

How Small Should a Transformer Be?

by
F. L. Woods, Manager—
Distribution Transformer Engineering

TODAY, with power companies anxious to install higher-rated transformers in existing vaults, or on present poles and pads, we are concentrating the G-E spotlight on size.

Pole-Type—We began to use Formex* wire in 1941 to reduce transformer size and gain operating benefits. Now, in most cases, a higher-rated unit fits the same mounting hardware and same poles as the lower-rated unit already in place. The new G-E 25-kva conventional transformer, for example, fits the mounting for a 15-kva unit hung 5 years ago.

Network—With load growing rapidly at the end of World War II, many operators asked for low-height units to permit replacing old 500-kva transformers with 750-kva units, thus saving expensive vault expansion. We introduced the first low-height design in 1955 and the new Vaultmaster represents our third height reduction.

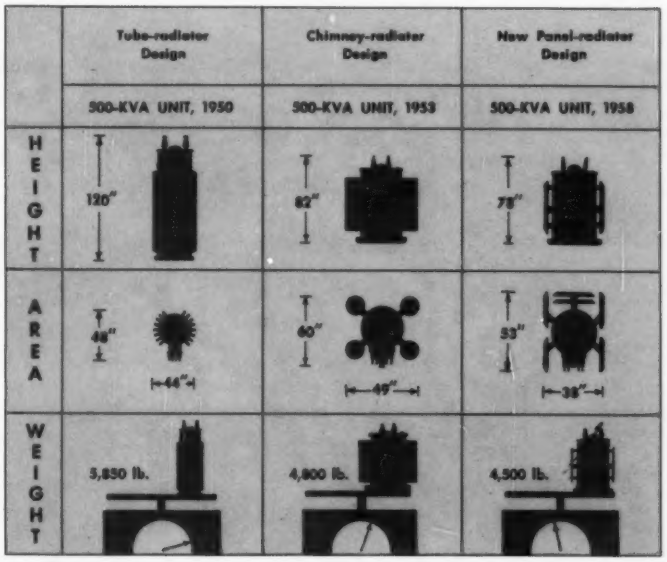
Substation—The smaller the area required, the less expensive it is to build a concrete mounting pad for three units, the usual grouping. Savings are even greater where the units are mounted on a platform between poles. Designed for such installations, the new G-E panel-radiator transformers require 20 percent less area than chimney-radiator units.

Apparently, for operators, a transformer should be as small as possible. We shall therefore continue our research to give you outstanding transformer performance in the smallest possible package.

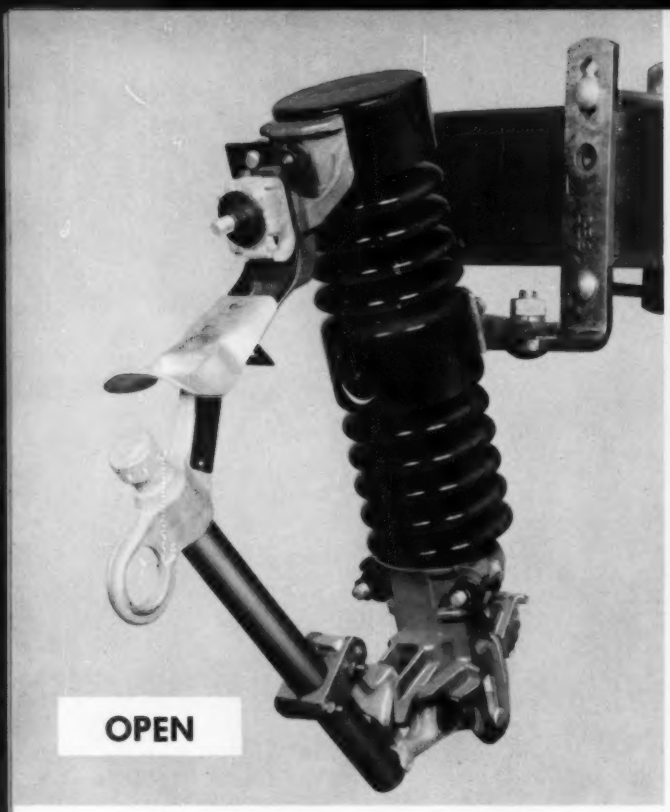
*Registered trademark of General Electric Co.

NEW PANEL-RADIATOR substation transformer, shown by W. B. Gaither, in charge of sales, simplifies installation and maintenance, and improves reliability. New unit is shorter, requires less floor space, is easier to clean and repaint than old-style tube-radiator unit, and the recently superseded chimney-radiator unit. Ninety-percent machine welding and fewer openings in tank improve reliability. New panel-radiator design is now available for all single-phase oil-filled ratings, 250 through 500 kva; also for oil-filled 225-kva, three-phase transformers, 15 kv and below.

New substation units: 20% less area . . .



Over 50 years of experience in building substation transformers culminate in new panel-radiator design (right-hand column). New unit requires about same small floor space as early tube-radiator design (left-hand column) has same low weight as chimney-radiator design.



Two New General Electric Cutouts

NEW EXTRA-HEAVY-DUTY OPEN DROPOUT CUTOUTS provide interrupting ratings of 10,000 amperes at 7.8 kv and 8,000 amperes at 15 kv. Low currents are cleared by utilizing the optimum bore size and venting the fuse tube at the bottom only. High current clearing is achieved by an expendable cap at the top of the fuse tube which permits double venting action.

NEW 100-AMP ENCLOSED FUSE CUTOUT, with gas loadbreak cylinder, can now replace more expensive switching devices. As the door is opened, a high-pressure blast of insulating gas automatically extinguishes a full-load power-current arc in 3 to 7 cycles. Replacing the used cylinder is simple and can be done on the pole in moments.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Recent Distribution Equipment Publications

SELF-PROTECTED DISTRIBUTION TRANSFORMERS
100 KVA and below—GEA 6126

PYRANOL® TRANSFORMERS
15,000 volts and below, single and three-phase
GEA 2048

SECONDARY LIGHTNING ARRESTERS
For 175-650-volt A-C power circuits and equipment GEA 2977

PELLET ARRESTER
For protection of 120/240-volt Secondary Circuits
GEA 4505

•

For copies of these publications, or more information on other G-E distribution equipment, contact your General Electric Sales Office or write to General Electric Company, Schenectady 5, N. Y.

431-74

you can count on quality performance

The stamp of quality which identifies the plants Ebasco designs and builds can also be found in the many services Ebasco offers. One of these services is purchasing.

Ebasco, as agent for its clients, has purchased well over one billion dollars worth of equipment and material during the past half century. But Ebasco's purchasing service does not end with procurement. It also includes inspection at factory, expediting shipment, and traffic arrangements . . . all smoothly integrated with the customer's requirements to insure that the right equipment is delivered on time, in first class condition, at the lowest possible cost.

Acting as purchasing agent only, Ebasco provides a completely unbiased service from the selection of the first manufacturer to the auditing of the last freight bill. Our purchasing specialists can serve you well . . . around the world, around the clock.

For more information about these services write: Ebasco Services Incorporated, Dept. M, Two Rector Street, New York 6, N. Y.

Challenging career opportunities are available for qualified engineers. For further information, write to our Personnel Director.

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BUSINESS CONSULTANTS

CONSULTING ENGINEERING • DESIGN AND CONSTRUCTION • FINANCIAL AND BUSINESS STUDIES • INDUSTRIAL RELATIONS • INSURANCE, PENSIONS AND SAFETY • PURCHASING, INSPECTION AND EXPEDITING • RATES AND PRICING • RESEARCH • SALES AND PUBLIC RELATIONS • SPACE PLANNING • SYSTEMS, METHODS AND BUDGETS • TAX • VALUATION AND APPRAISAL • WASHINGTON OFFICE

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IF IT CARRIES CURRENT, KW CARRIES IT!

MOORESVILLE, IND.

KW® SE-U SAVES ON SERVICE

The new home shown at the right was wired recently as a model unit to test the economy of adequate wiring with modern KW *Aluminum* wire and cable. Here's the result:

100 ampere service on KW Aluminum costs less than 65 ampere service on copper.

With loads steadily building up, the trend is toward larger sizes. At the same time, *savings with aluminum become even more important.*

Typical example: the cost of #3 copper conductor is *89%* higher than #2 aluminum conductor! (Both sizes meet National Electrical Code requirements for 100 ampere service.)

SE-U Economical In Special Applications

As demonstrated in the Mooresville home, savings with aluminum SE-U do not end at the switch box. For hook-up of built-in range, hot water heater and dryer, KW Aluminum SE-U unquestionably provides savings over copper non-metallic sheathed cable, as well as greater safety through higher quality product.

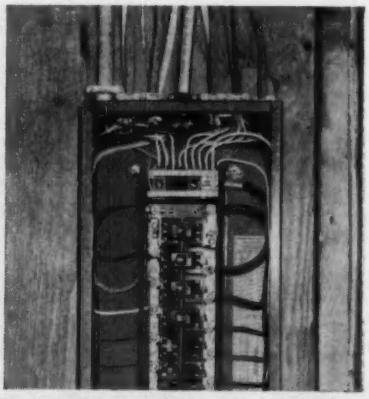
In short, KW Aluminum SE-U will save you money and help you improve service all the way from the pole to the appliance!

For immediate service, or for further information and samples, call the Kaiser Aluminum sales office or the KW distributor listed in your telephone directory.

Kaiser Aluminum & Chemical Sales, Inc., *Executive Office,* Kaiser Bldg., Oakland 12, California; *General Sales Office,* Palmolive Bldg., Chicago 11, Illinois.

KW Aluminum SE-U may be brought directly to water heaters in homes or commercial buildings.

Range hook-up in Mooresville model home shows how KW SE-U may be used "as is." Elimination of conduit increases savings.



Main switch panel shows variety of KW Aluminum wiring applications. They are as easy to work with as copper.

CONTRACTOR SHOWS HOW ENTRANCE, APPLIANCE HOOK-UPS

KAISER ALUMINUM

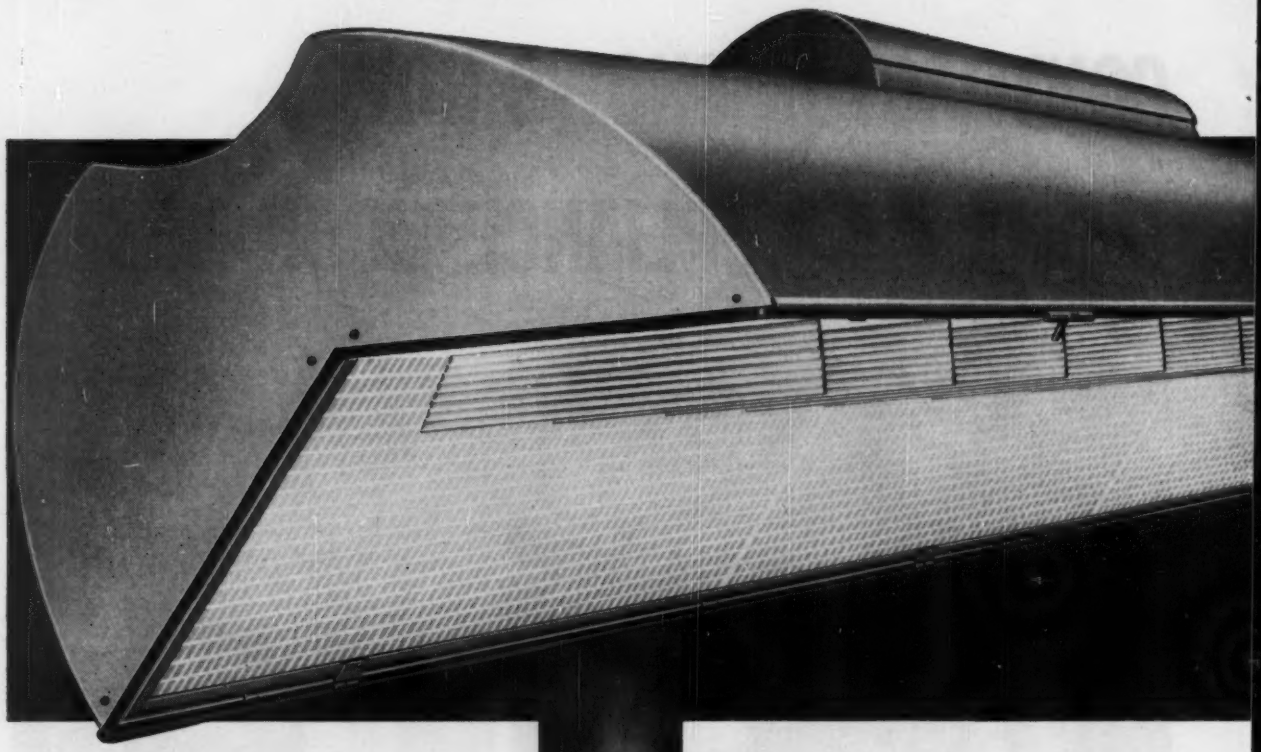
LIVE BETTER ELECTRICALLY

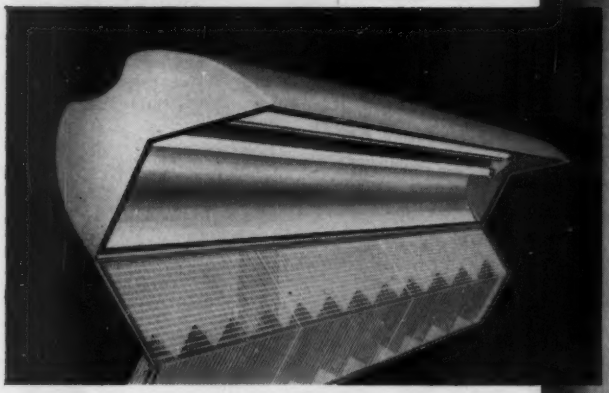
IF IT CARRIES CURRENT, K/A CARRIES IT!

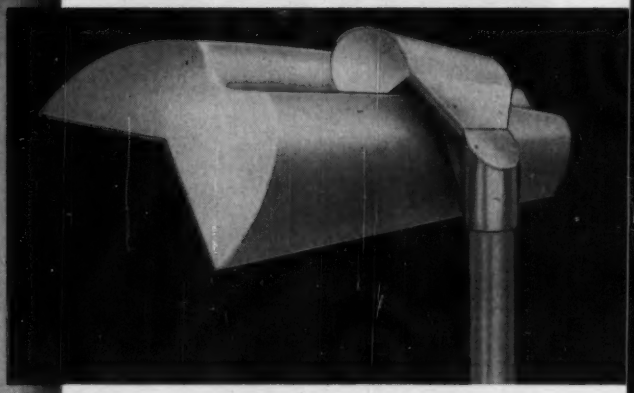
See "MAVERICK" • Sunday Evenings, ABC-TV Network • Consult Your Local TV Listing

NEW MAINSTREETER

by Westinghouse







MAINSTREETER INNOVATIONS—GUIDE TO ALL FUTURE STREET-LIGHTING LUMINAIRE DESIGN:

Modern fiber-glass housing *cannot* be dented, is *corrosion-free*, never needs painting. Variety of heat-treated cast-aluminum brackets gives wide choice of mounting arrangements. Newly engineered reflectors of aluminized plastic have *exceptional* specularity! Exclusive acrylic refractor *controls* light *two* ways: interior lenses direct more than 50% greater light output onto the roadway; prismatic louvers direct light *again —further* shielding light from drivers' eyes! Sponge vinyl gasket eliminates moisture, bugs and dust; maintenance is negligible. Stainless-steel hardware retains "new" appearance. Remarkably improved ballast is easily accessible underneath "matching" cover in the support yoke, *eliminating* heat problems! "Universal" lampholders accommodate *all* rapid-start fluorescent lamps, including high-loaded lamps, giving MAINSTREETERS an almost limitless service-life! Simple switch of lamps and ballasts permits *any* circuit operation! J-04435

PARALLEL TO THE STREET! NO GLARE!

WHAT'S MORE—DELIVERS 50% MORE LIGHT TO THE ROADWAY

THAN ANY PREVIOUS FLUORESCENT LUMINAIRE!

Never before—street-lighting like this!

There is now a luminaire that provides faster, more *accurate* seeing—with *greater comfort for drivers!*—than any previous fluorescent street-lighting fixture ever developed! It is the striking new MAINSTREETER luminaire, created by Westinghouse. Moreover, MAINSTREETERS deliver efficiency of performance never achieved with fluorescent street-lighting before!

The sleek MAINSTREETER housing, of "indestructible" fiber-glass, mounts *close* to the pole and *parallel* to the street! So MAINSTREETERS avoid the cluttered daytime appearance of luminaires protruding out over the street. And the housing-ends of MAINSTREETERS—combined with special louvers on the refractor—completely shield drivers' eyes from nighttime glare of the lamps. Vision is unimpaired!

Cast-aluminum brackets provide adequate adjustment for levelling—plus the capability of tilting the luminaire for unusual applications. The entire unit is designed to give *ideal* light-distribution, conforming *exactly* to the street width!—providing *uniform* foot-candle levels—and a definition of objects impossible in the past! With less distraction and better seeing by "everyone," accident rates will be still further reduced!

In addition, new DUAL optical systems PUT OVER 50% MORE LIGHT ON THE STREET!

The *entire* output of MAINSTREETER lamps is now controlled *two* ways! MAINSTREETER refractors have, *inside*, a pattern of countless prismatic lenses—directing *more* light, from contour-engineered reflectors, *specifically* down onto the street! Then, on the *outside*, twelve exclusive prismatic louvers *again* control this light—to achieve a new concept of street-lighting comfort! The result is *better than 50% more complete utilization of all light produced by the lamps!*

See, at left, all *eight additional* features of MAINSTREETER luminaires—*already establishing* all future street-lighting design! Nothing parallels MAINSTREETERS—parallel to the street!

Watch Westinghouse Achievements in Lighting

Orders Accepted Now!

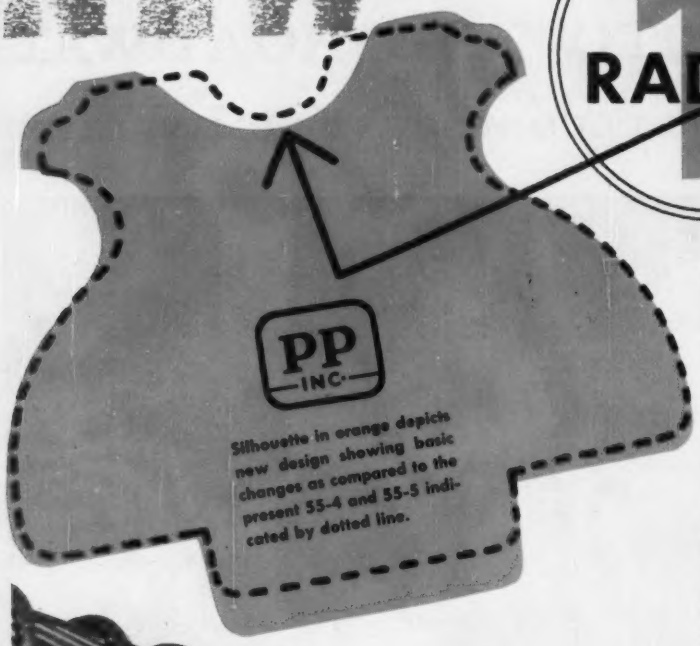
Volume production of MAINSTREETERS already is underway! Traffic engineers "everywhere" proclaim the hope of vastly improved safety records. And this is the expectation of MAINSTREETER illumination! Call your near-by Westinghouse representative for preferred delivery list information TODAY. Or, write to Westinghouse Electric Corporation, LIGHTING DIVISION, Edgewater Park, Cleveland, Ohio, RIGHT AWAY!

YOU CAN BE SURE...IF IT'S

Westinghouse

NEW 1" RADIUS WIRE GROOVE PIN-TYPE INSULATOR

specifically engineered for **YOU**


PP
INC.
Silhouette in orange depicts new design showing basic changes as compared to the present 55-4 and 55-5 indicated by dotted line.

Two proposed future EEI-NEMA standard insulators.

1. **Characteristics comparable to the present 55-4 and 55-5.**
2. **Handles ACSR and All Aluminum up to 795,000 over rods.**
3. **Minimum side groove of ⅝".**
4. **Finest wet process porcelain available.**

Designed and engineered for YOUR current and future use of larger conductors.

LIVE BETTER ELECTRICALLY

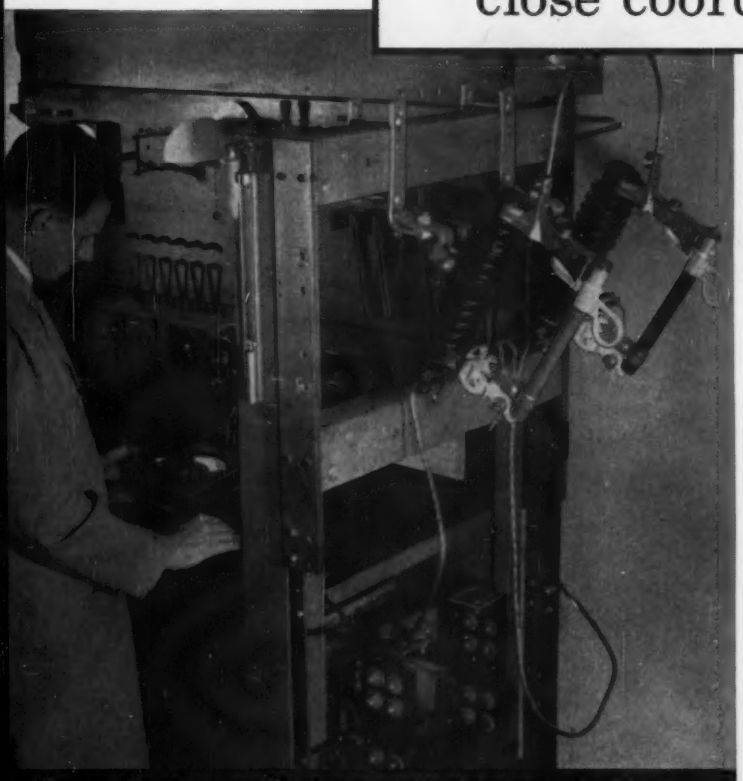
PORCELAIN PRODUCTS, INC.
CATALOG NO'S. 6191-6192
RADIO FREE OR PLAIN

Porcelain Products, Inc.

High Voltage Division — **Parkersburg, W. Va.**

It takes KEARNEY QUALITY in Fuse Links

to give you positive protection . . . close coordination



Controlled manufacture and rigorous testing provide maximum service continuity

Quality control in KEARNEY Fuse Links starts with design . . . and continues through careful selection of materials, precision parts manufacture, expert assembly and strictest inspection and testing. The end result is dependable protection . . . uniformity that guarantees all Fuse Links of the same rating will perform exactly alike.

ALL KEARNEY Fuse Links feature low temperature operation. Pure tin elements or low melting point solder, selected for proper strength and melting temperature for each current rating, keep temperatures inside the cutout tube well below charring point. This provides accurate, positive arc clearance even after long periods of overload.

Take care of your requirements in Specialized and Standard Fuse Links with KEARNEY. Contact your KEARNEY Representative.

JAMES R. KEARNEY CORPORATION • 4224-42 Clayton Avenue • St. Louis 10, Mo.

FOR BETTER CONSTRUCTION—SAFER MAINTENANCE

Specify Kearney Products

Plants at: ST. LOUIS • FAYETTEVILLE, ARKANSAS • SHENANDOAH & CLARINDA, IOWA • GUELPH, ONTARIO, CANADA

393

KELLOGG'S FABRICATING TECHNIQUES KEEP PACE

Fabrication of the Type 316 Stainless main steam piping for Philadelphia Electric Company's new Eddystone Station, Unit No. 1, comes nearer to completion—in The M. W. Kellogg Company's Jersey City shops.

Designed for use at a record 5,000 psi-1200 F., these steam lines required the heaviest wall thicknesses ever used in Type 316 steam-electric plant piping.

To fabricate 2,400 ft. of such heavy-walled stainless piping to exacting specifications is, in itself, a task that few fabricators could be entrusted to undertake. For many years M. W. Kellogg has been testing and evaluating materials, and perfecting fabricating techniques, in conjunction with the foremost power companies and major equipment suppliers. This experience assures today's ultimate in operating efficiency.

Kellogg welcomes the opportunity to discuss its complete power piping design, fabrication, and erection facilities with consulting engineers, engineers of power generating companies, and manufacturers of boilers, turbines, and allied equipment.

Photo above, of section of Type 316 piping being welded, dramatically shows ratio of wall thickness to inside diameter. This section has already been bent, in rear, to a 90° angle. Below, welded joints of smaller section of Type 316 being ground to dimensions. The bend on this section is visible at left.

Fabricated Products Sales Division

THE M. W. KELLOGG COMPANY, 711 THIRD AVENUE, NEW YORK 17

A SUBSIDIARY OF PULLMAN INCORPORATED

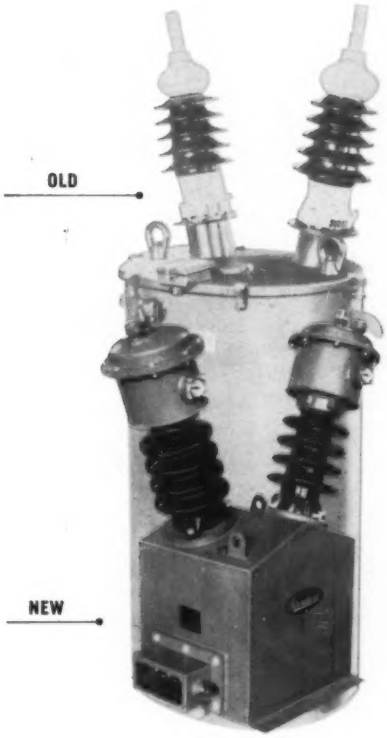
The Canadian Kellogg Co., Ltd., Toronto • Kellogg International Corp., London • Kellogg Pan American Corp., New York • Societe Kellogg, Paris • Companhia Kellogg Brasileira, Rio de Janeiro • Compania Kellogg de Venezuela, Caracas

POWER PIPING—THE VITAL LINK

OUTDOOR METERING TRANSFORMERS...

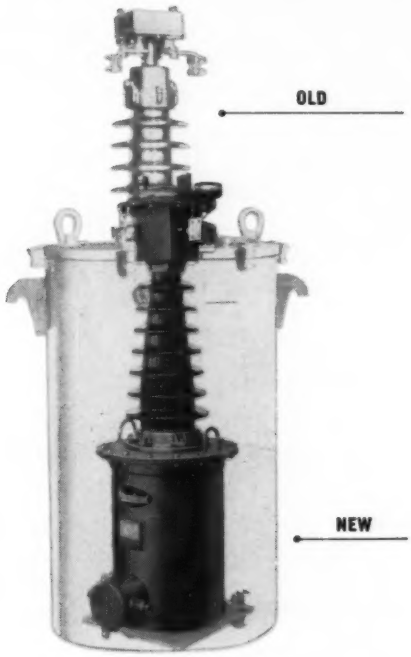
...accuracies within 0.3% at all ASA standard burdens

Standard Transformer's new line of completely redesigned outdoor metering transformers gives maximum accuracy on all metering applications. The vacuum impregnating process removes all traces of air from the heated core and assembly, resulting in the highest dielectric strengths. The new line conforms to all ASA, EEI and NEMA mounting and accuracy standards. These transformers are smaller and lighter than ever before. For specifications and certified dimension prints, see your nearby Standard Representative or write directly to us. You'll increase your accuracy where it counts most—ahead of and at the meter.



TYPE PXO OISC POTENTIAL TRANSFORMER

—outdoor type. Up to 69,000 volts primary; 120 volts secondary and secondary terminal box. Also available with single bushing for line to ground connection.



TYPE CWO OISC CURRENT TRANSFORMER

—outdoor type. Up to 69,000 volts; and up to 400/800 to 5 amperes. With oil level indicator, primary bypass protector, and secondary terminal box.

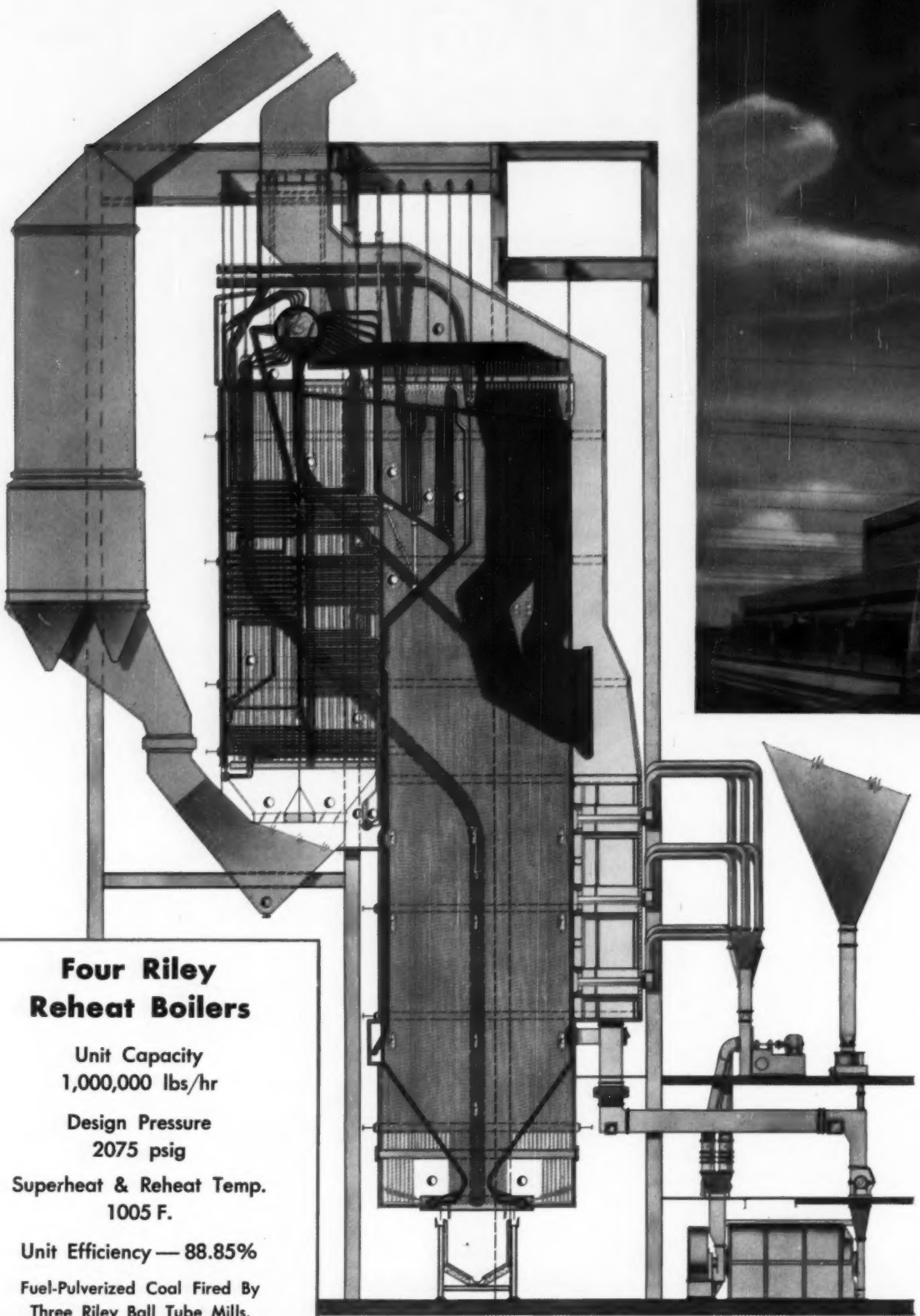
LIVE BETTER ELECTRICALLY

Phone 2-1563

Standard Transformer CO.

WARREN, OHIO

"WHEREVER THERE IS POWER"



Four Riley Reheat Boilers

Unit Capacity
1,000,000 lbs/hr

Design Pressure
2075 psig

Superheat & Reheat Temp.
1005 F.

Unit Efficiency — 88.85%

Fuel-Pulverized Coal Fired By
Three Riley Ball Tube Mills.
Eighteen Riley Flare Type Burners

A survey of your plant by qualified consulting engineers could show ways of making surprising savings in your power costs.

The proposed New Albany Power Station as it will appear with six units

PUBLIC SERVICE COMPANY OF INDIANA, INC. INSTALLS

Four Complete RILEY Reheat Boilers

AT NEW ALBANY POWER STATION

SARGENT & LUNDY, *Engineers*

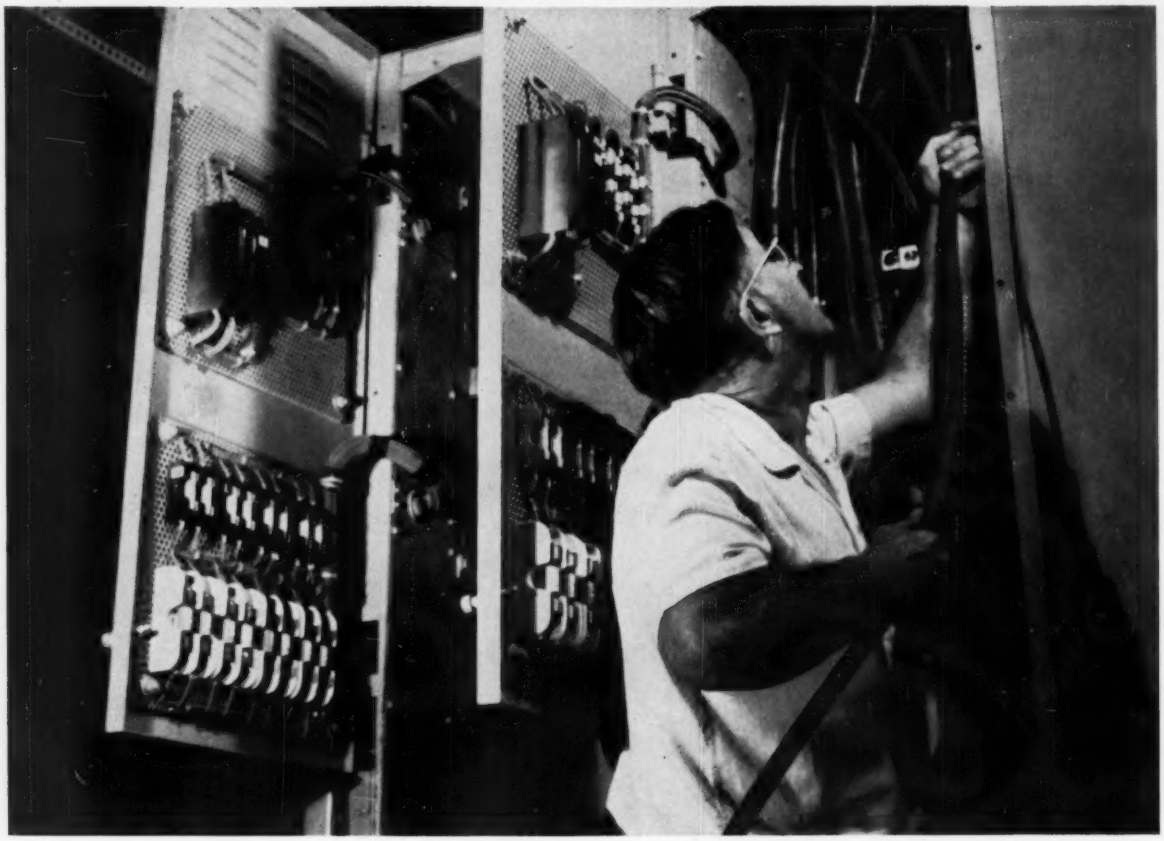
The four Riley Reheat Units in progress of installation at New Albany Power Station, New Albany, Indiana, are part of a major expansion program of Public Service Company of Indiana, Inc. All four units utilize the same design features to assure top performance . . . the use of radiant superheater, water tube platens to produce uniform furnace exit gas temperatures, damper control of reheat steam temperatures and the use of spray type steam temperature control. In addition, well balanced flame placement by Riley Flare Type Burners and sustained high fineness of pulverized coal by Riley Ball Tube Mills produce dependable and efficient combustion.

Public Service Company of Indiana, Inc. also has a number of pulverized coal fired Riley boilers operating in other central stations in its system; one, an 805,000 lb/hr. Reheat unit at Wabash River Station has been operating since May, 1956.

For complete details on other Riley boiler designs and fuel burning equipment write *Riley Stoker Corporation, Worcester, Massachusetts.* Riley representatives are in these principal cities: Atlanta, Buffalo, Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Houston, Kansas City, Los Angeles, New Orleans, New York, Philadelphia, Pittsburgh, Portland, St. Louis, St. Paul, Salt Lake City, San Francisco, Seattle, Worcester.

RILEY

STEAM GENERATING & FUEL BURNING EQUIPMENT



When you must pack a lot into a small space . . . specify Rome's "CT-2" control cable

These cables are intended for installation in underground conduits or ducts, directly in the earth, or open air.

Conductors: Conductors conform to ASTM Specification B-8.

Insulation: Insulation conforms to IPCEA Appendix P.

Color Coding: All conductors shall be color-coded in accordance with IPCEA recommendations.

Assembly: For three conductors or more, the insulated color-coded conductor shall be twisted with jute fillers when necessary to make round, and a suitable tape shall be applied over the assembled core. Two-conductor cable shall be flat.

Over-all Sheath: An over-all sheath of Rome Synthinol* shall be applied over the tape core.

Here's a way to speed up the job of making complex control-panel connections in tight quarters. Install cable that meets your *budget, quality,* and *space* requirements.

You'll find that just such a cable is Rome's "CT-2" control cable. Its smaller diameter will fit into your most compact panel arrangements. It's lightweight, too, and easy to pull through conduit. And it represents good quality at moderate cost.

Your choice of cable sizes

This low-surface-friction cable has an all-thermoplastic construction featuring 3/64" Rolene insulation (polyethylene) plus an over-all sheath of Rome Synthinol (polyvinyl chloride).* It's available as a standard construction with one to 12 conductors in No. 9 and No. 12 AWG sizes.

Insulation: Sure and dependable terminations are possible because Rolene strips cleanly. This smooth, positive-stripping polyethylene lets you consistently make an efficient installation.

Sheath: Rome Synthinol is a thermoplastic (PVC) compound that offers high resistance to oils, most acids, alkalis, grease, gasoline, weathering and flame.

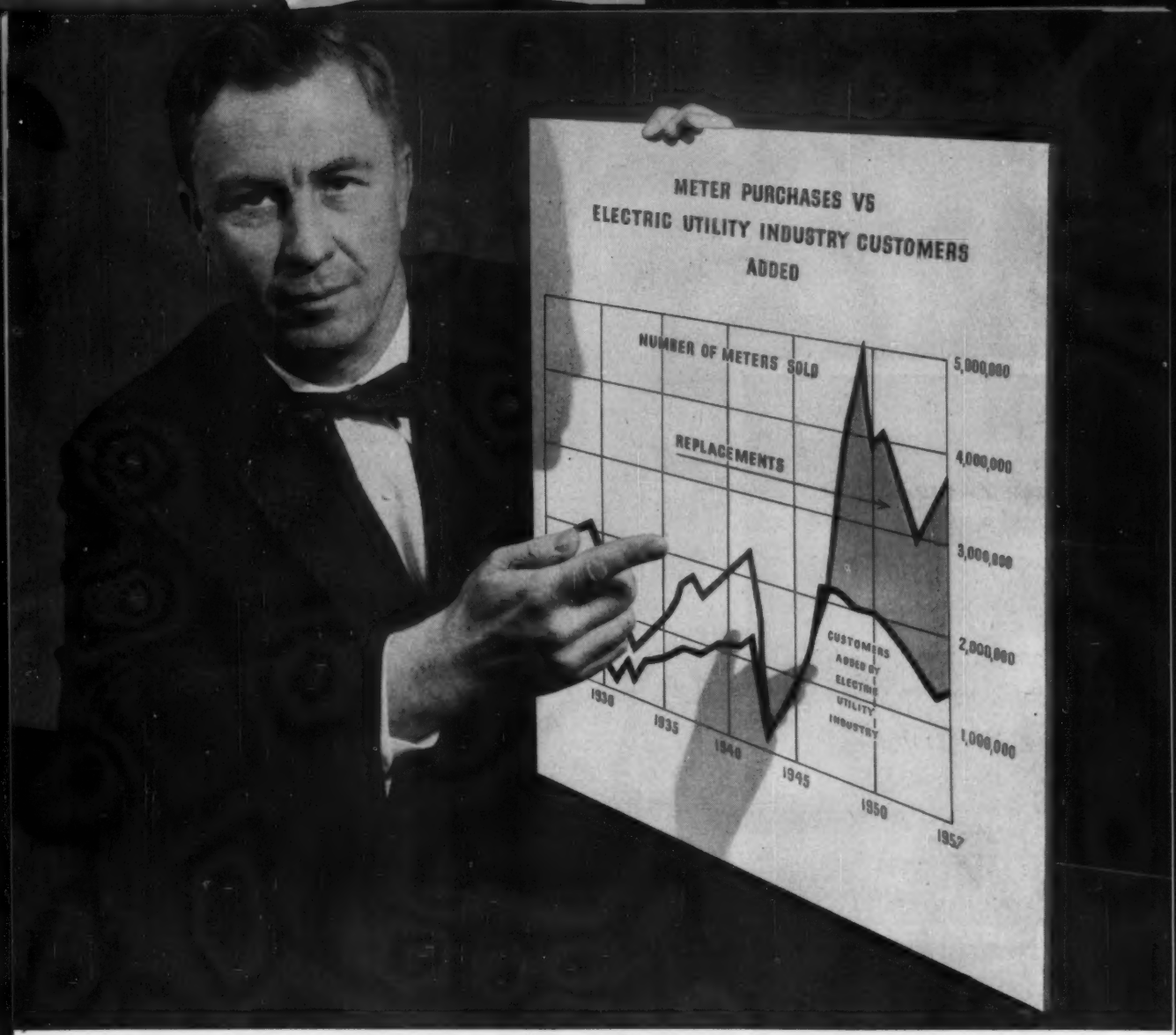
Use Rome's "CT-2" control cable for your next job where space is at a premium and fast, efficient installation is mandatory.

Find out how Rome's control cable can fit your installation picture. Contact your nearest Rome Cable representative—or write to Department 852, Rome Cable Corporation, Rome, N. Y.

*Alternate sheaths of Rolene (polyethylene) or Roseal (flame-resistant polyethylene) are also available.

ROME CABLE

CORPORATION



In the past ten years, 15 million meters have been needed to replace obsoleted units.

Will this costly replacement program hit you again in 1965?

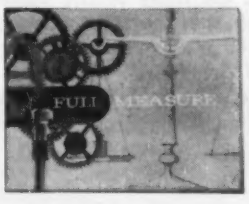
J. A. Babcock, Manager
Watthour Meter Department
Westinghouse Electric Corporation

Obtaining Full Measure for your meter investment means meter capacity and durability for many years of dependable service.

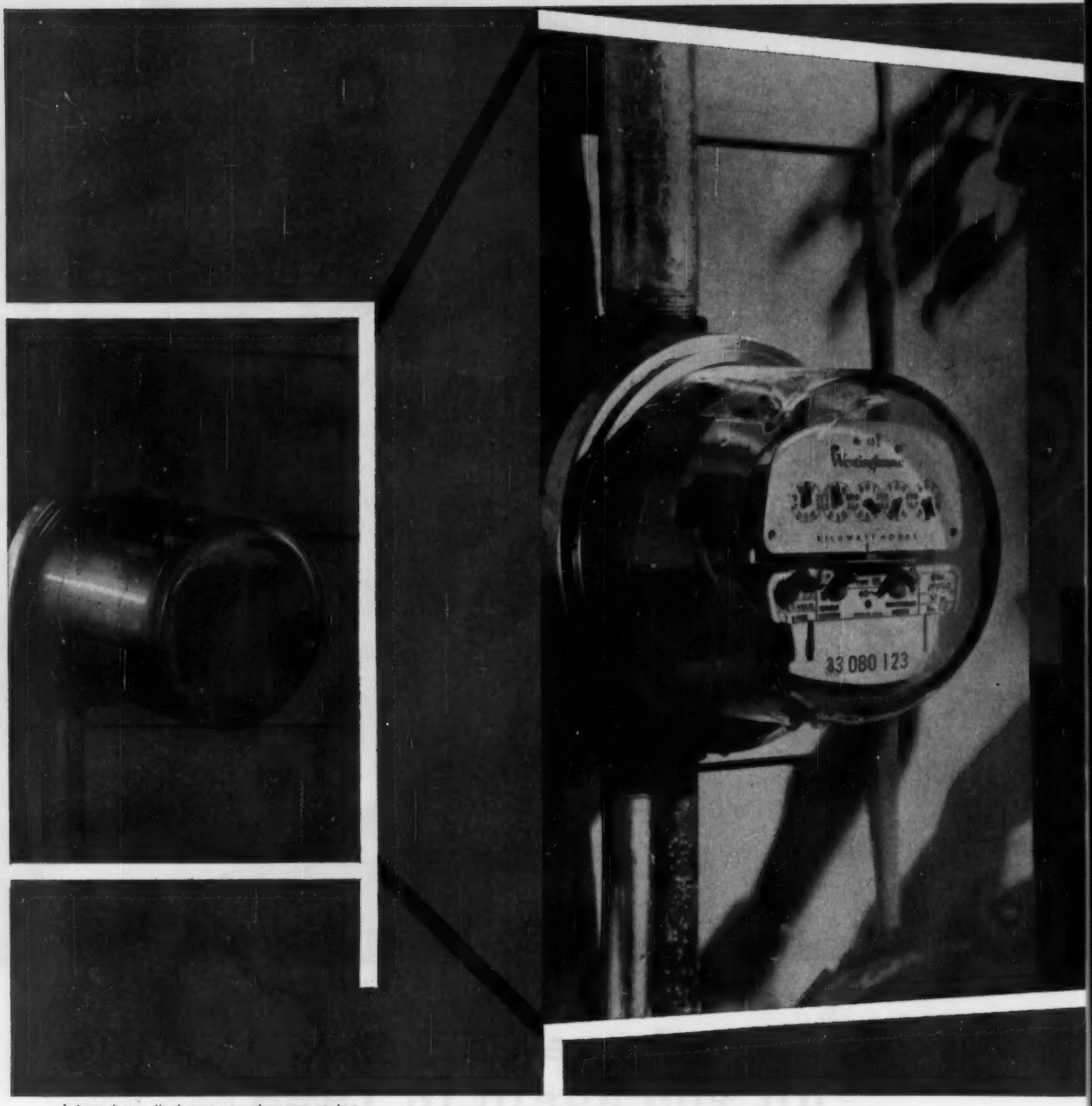
The above chart indicates the number of meters the electric utility industry has been forced to purchase... over and above the new customers added. This expenditure reflects the replacement of many of the obsolete meters presently in service. Not that they are failing in any way to do the job for which they were built! The growing loads have simply found the old 5-and 10-ampere meters inadequate for this task.

The moral of the story is: Buy Class 200 meters with the capacity to meet your present and future loads... at the same price you've paid for conventional 15-ampere single-phase meters. It's another example of the Westinghouse philosophy of Plowback of Earnings for research.

Westinghouse has consistently pioneered significant contributions to the art of metering: the basic concept of the a-c meter, stroboscopic testing... among many others, the meter socket, first extended range meter, and automated load survey equipment. Buy Westinghouse meters to assure *continued Full Measure* in product superiority and forward-looking research. J-40508



Has your Westinghouse representative shown you how to get Full Measure for **your** meter dollar? Ask him for a copy of this informative presentation, B-7280.



Internal arc discharge can damage meter

From Westinghouse...TRUE lightning protection

Westinghouse *Lifetime* meters offer the only complete lightning protection in the industry . . . protection of the meter itself. Devices on most conventional meters will discharge surge voltages and prevent possible household fires. However, surges discharged within the body of the meter may spatter bits of molten metal on the working parts, crack the glass cover or otherwise seriously hinder the functioning of the meter.

Lifetime single-phase meters by Westinghouse are equipped with exclusive De-ion® arrester gaps set in the base and arranged to discharge surges harmlessly, outside the meter. Surge voltages can't damage the meter or destroy its accurate functioning. On repeated discharges, the gaps maintain their breakdown level well under the surge insulation strength of the coils.

Five major superiorities enable Westinghouse to guarantee its watthour meters for a lifetime . . . the result of a policy of Plowback of Earnings into research to bring you products of highest quality and performance.

Westinghouse De-ion Arrester

and a Lifetime guarantee

- Range—up to 200 amps . . . sufficient to handle all present and future loads.
- Thermal Capacity—ability to give outstanding service and long life at extremes of temperature and high overloads.
- High Insulation Levels—to withstand high-voltage surges without damage.
- Stability—long-time accuracy because meter is inherently stable, mechanically, electrically and magnetically.
- Corrosion Protection—finishes and materials are selected and coordinated for maximum corrosion protection and long, economical service life.

For full information on Westinghouse *Lifetime* meters, call your local Westinghouse representative, or write Westinghouse Electric Corporation, P. O. Box 868, 3 Gateway Center, Pittsburgh 30, Pennsylvania. J-40506

YOU CAN BE SURE...IF IT'S Westinghouse

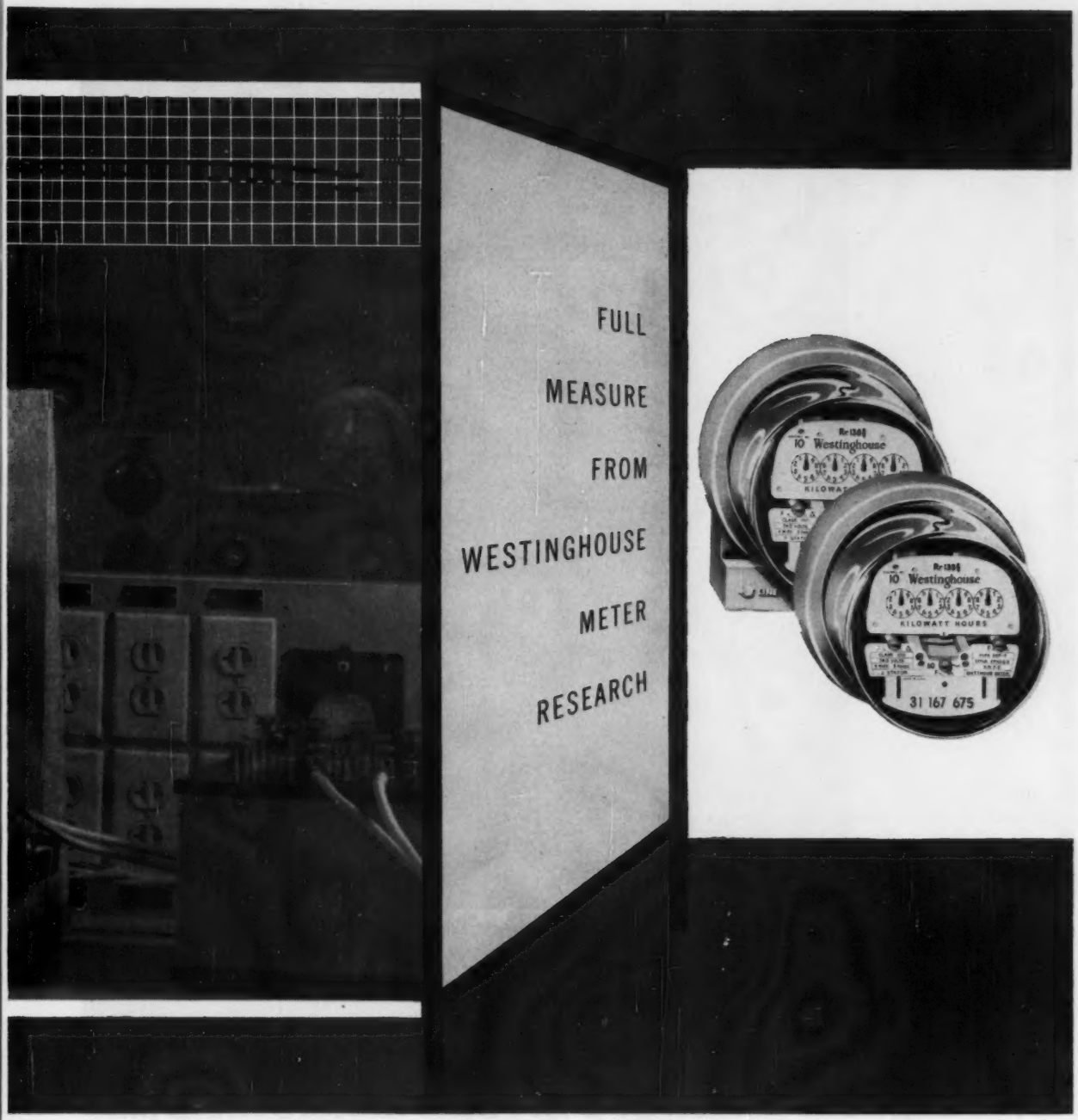
Straight-line accuracy up to 667% of rating . . .

Just three knobs for all calibration adjustments

Now . . . a polyphase meter with all the

Through Plowback of Earnings in research, Westinghouse engineers a few years ago developed the first polyphase meter with a single-phase disc to nullify electrical interference between the meter elements. This unique yet simple design raised the performance standards of polyphase metering . . . giving us the first extended-range capacity . . . up to 667% of rating with straight-line accuracy and starting watts usually associated with single-phase meters.

Not only does the new Westinghouse design provide utilities with a big reserve to meter the growing polyphase loads in the years ahead . . . it also offers real economy in service and testing. For instance, Fred Mindt, engineering section manager (shown above), points out that only

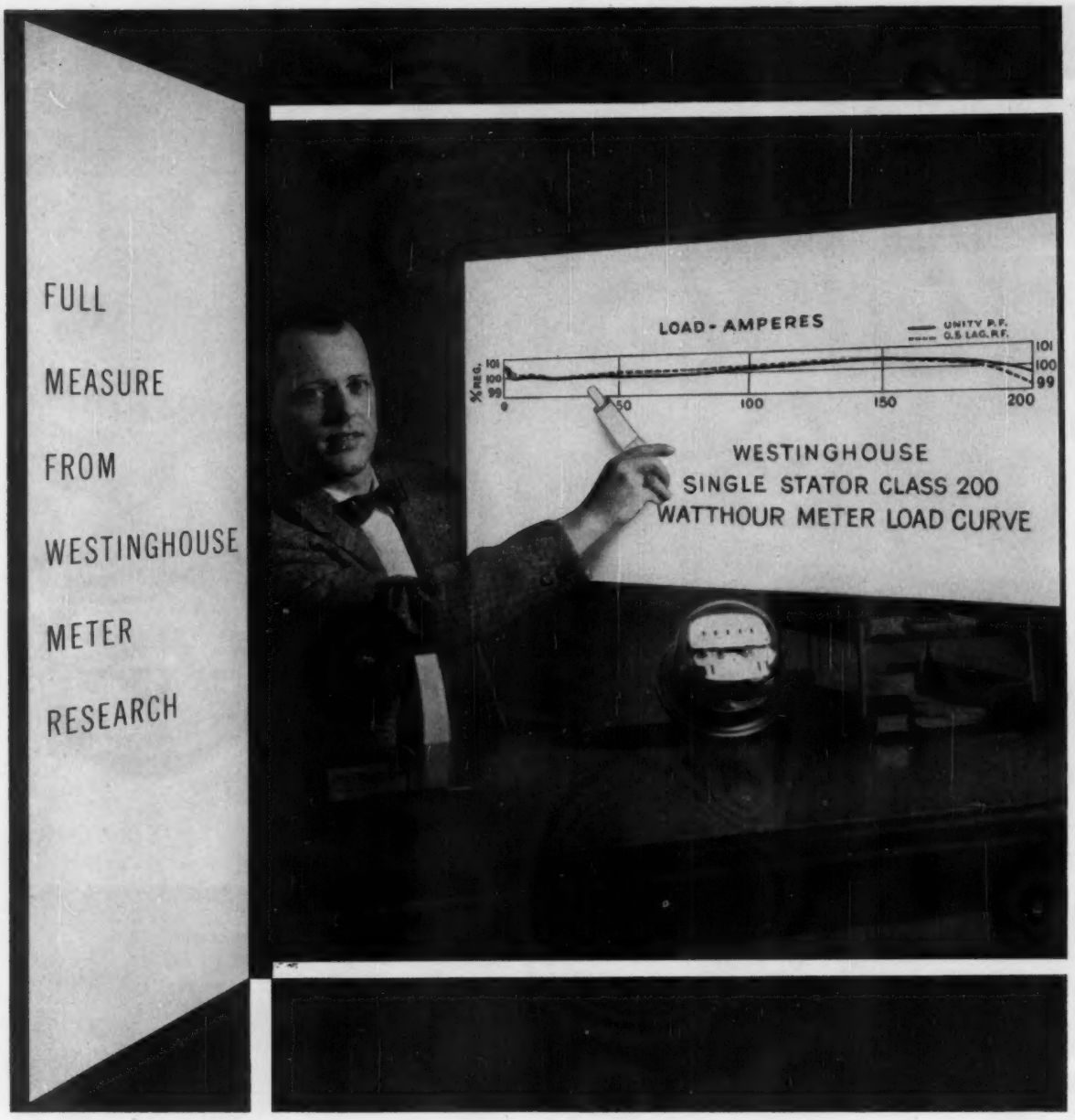


economies you get in 1$^{\varnothing}$ metering!

three calibration adjustments are needed (light-load, full-load and phase-balance) . . . all easily accessible from the front by simply removing the cover. The large knurled knobs can be turned without a screwdriver. All adjustments feature approximately 1% per-turn sensitivity.

To learn how to receive Full Measure for your polyphase meter investment, call your Westinghouse salesman or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-40507

YOU CAN BE SURE...IF IT'S Westinghouse



Westinghouse class 200 lifetime meters insure... straight-line performance on all loads

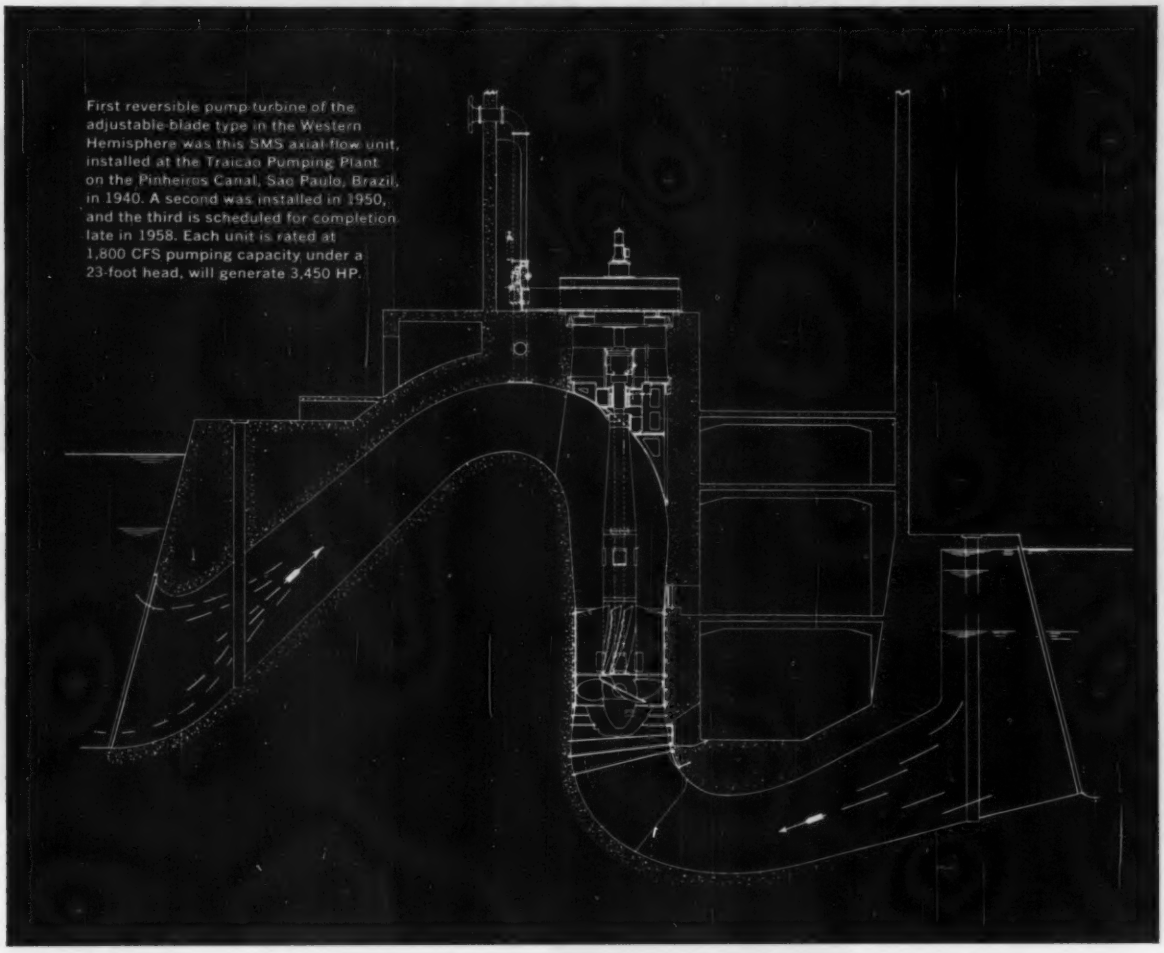
Today's wide residential load range requires a meter that has both accuracy and ample capacity. The Westinghouse Class 200 Lifetime meter licks these two main problems — need for greater load capacity to meet present and future demands, and sensitivity to register accurately the many light loads which might escape notice on ordinary 30-ampere meters. In short, the Westinghouse Class 200 makes standardization on 30-ampere meters a paying proposition for utilities.

In the photo above, Fred Mindt, Engineering Section Manager at the Westinghouse Raleigh, North Carolina, Meter Plant, points out accuracy of registration of loads as low as ½ ampere or 120 watts — which is ¼ of 1% of maximum capacity.

For full information on Class 200 Lifetime meters, call your Westinghouse Representative, or write Westinghouse Electric Corporation, P.O. Box 868, 3 Gateway Center, Pittsburgh 30, Pennsylvania.

J-40505

YOU CAN BE SURE... IF IT'S Westinghouse



First reversible pump-turbine of the adjustable-blade type in the Western Hemisphere was this SMS axial-flow unit, installed at the Traicao Pumping Plant on the Pinheiros Canal, Sao Paulo, Brazil, in 1940. A second was installed in 1950, and the third is scheduled for completion late in 1958. Each unit is rated at 1,800 CFS pumping capacity under a 23-foot head, will generate 3,450 HP.

THIRD SMS PUMP-TURBINE UNIT ORDERED FOR TRAICAO PUMPING PLANT

These SMS adjustable-blade, axial-flow, pump-turbines at Traicao are the first reversible pump-turbines designed and manufactured in this hemisphere, and probably the only axial-flow units of this type in the world. SMS also manufactures other types. At the Pedreira Plant in Brazil, for instance, a more conventional centrifugal pump-turbine was installed in 1947. This SMS unit, operating under a 91.8-foot head, pumps 1,497 CFS at 138.5 RPM, and is rated at 16,000 HP when generating.

Recently, the Power Authority of the State of New York has placed an order with S. Morgan Smith for the manufacture of six pump-turbines for the Tuscarora Plant at Niagara Falls, New York. Each of these units is rated at 28,000 HP when generating, and at 3,400 CFS when pumping.

In addition to single-reversible, dual-purpose units like those at Traicao, Pedreira, and Tuscarora, SMS helped pioneer pumped-storage. The first large-scale application of separate pumps and turbines in the U. S. was for Connecticut Light & Power Company's Rocky River Plant, built in 1926. Here an SMS-Francis turbine, rated at 36,100 HP under a 226-foot head, was installed.

These installations are part of a broad background of experience in the engineering, designing and manufacturing of pump-turbines that is available to you at SMS. For information, write to S. Morgan Smith Company, York, Pennsylvania.

More Power To . . . LIVE BETTER ELECTRICALLY

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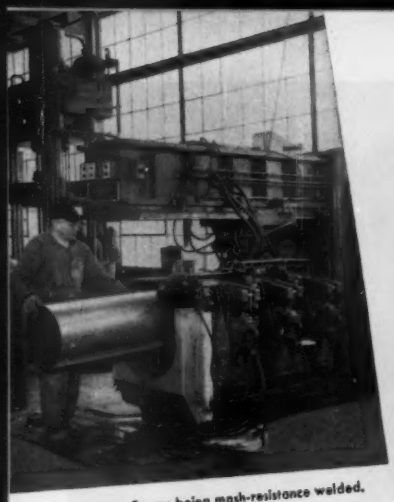
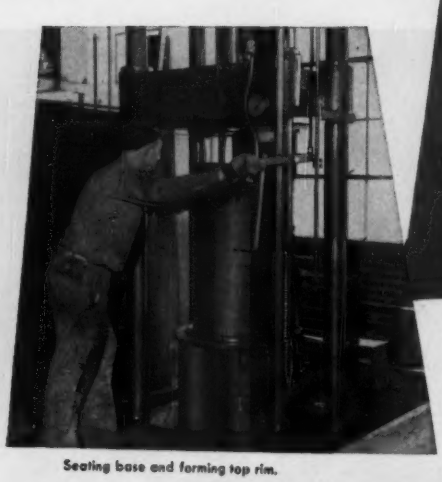
TOUGH TANKS...

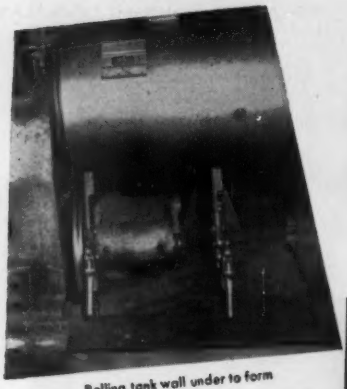


Seams being mash-resistance welded.

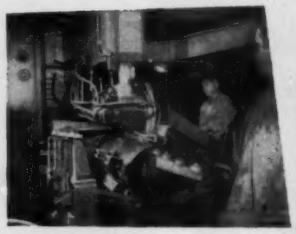


Seating base and forming top rim.

Welding tank base to the shell.



Rolling tank wall under to form triple thickness at base.



Automatic positioning resistance welder welding fins to tank.

Welding fixtures to tank wall.

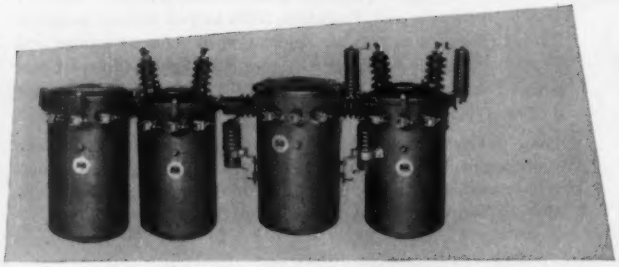
Pressure testing tank.

The quality and performance of Moloney Transformers is protected by tanks rugged enough to keep oil in and weather out . . . under all conditions.

Moloney tanks of copper-bearing steel with mash-resistance welded seams are built tough to take it. To provide triple thickness of metal at the bottom of the tank, the bottoms are seated, welded, rolled under and sealed against moisture with a special mastic. Each tank is pressure-tested for leaks before painting. Tanks move along the assembly line on pallets to eliminate possible damage to the finish. Retained gaskets are provided on Moloney Distribution Transformers and after assembly and automatic testing, every transformer is "tilt-tested" for gasket leaks.

Tough tanks . . . another reason for specifying Moloney wherever transformers must perform dependably under all operating conditions.

For Quality and Dependability . . . All along the line . . . contact your nearest Moloney representative.



Moloney Distribution Transformers conform to EEI-NEMA standards and are available in all standard ratings and types.

ME58-6

MOLONEY ELECTRIC COMPANY

Manufacturers of Transformers for Utilities, Industry, and Electronic Applications

FACTORIES AT ST. LOUIS 20, MO. AND TORONTO, ONT., CANADA

MARCH 24, 1958

A Lesson in Unity: The Zinder Report

Recently the gas industry issued a lengthy and impressive report entitled, "Gas and Electric Service in Multiple Housing—Criteria for Determining the Costs of Gas and Electric Service in Military and Public Housing Projects" (see page 66). Known popularly as the "Zinder Report", it purportedly shows the difference in cost to the customer among three types of service entrances:

All Gas—Gas used for cooking, water heating, space heating and summer cooling. Electricity to be used only for lighting, small appliances and refrigeration.

Combination Gas and Electric—Same as the first plan except that an electric air conditioning system is used in place of gas for summer cooling.

All-Electric—Electricity used for all purposes with an electric heat pump for space heating and summer cooling.

The Zinder report attempts to show under the conditions it assumes, that the cost to the customer of combined gas and electric service is much less than all-electric. It is, as its formal title implies, directed toward those agencies in the federal government responsible for multiple housing, such as the Capehart projects and other military housing.

To the general reader and even to some of the more careful analysts who are appraising this report, its conclusions, though surprising, seem believable. Upon closer examination, however, these conclusions, and their premises raise more questions than they answer. Moreover, it's noteworthy that all operating costs comparisons and the generalizations flowing from them are based on only one example.

But what makes the Zinder report particularly important at this time is the unity of purpose among the gas interests that it demonstrates. This is the challenge to the electric utilities that is highlighted by publication of the Zinder report. With this report as their charter, gas interests are moving ahead rapidly, in a united effort to promote their story to every important buying influence in the national housing market.

Not only are housing officials in Washington being bombarded with the findings of this report, but architects, consulting engineers, large contractors, and other important customer groups are being influenced. Like all significant reports, the Zinder report will be used by many influential people as a touchstone and basis for many other comparisons and related reports.

The electric industry has been put "on the spot" by conclusions and data based on arbitrary assumptions. It is time to close ranks for the battle. Preliminary steps are already being taken. One group in the industry is now at work on a factual all-electric comparison for its region. This will be brought before the industry soon.

To be meaningful such comparisons of all-electric vs gas-and-electric service must not only be done on a geographical area basis but also backed by united industry effort. The need for such an effort is immediate. It demands united support from all utilities believing in the future of the all-electric home.

The Zinder Report: What Does

Many things, but mostly it is seen as the first offensive in a coming series of regional battles between gas and electric interests for the increasingly important government multiple housing market. Electric men question its assumptions, emphasize importance of local conditions

The electric utility industry is facing an old adversary armed with a new weapon.

The adversary is the nation's gas industry, and the new weapon is a publication entitled "Gas and Electric Service in Multiple Housing—Criteria for Determining Costs of Gas and Electric Service in Military and Public Housing Projects," commonly known as the "Zinder Report." With it, the gas industry is mounting a powerful offensive to capture the multiple housing market, Federal and otherwise, in the U. S.

The report, prepared by Clifford A. Brandt of H. Zinder & Associates, Inc, Washington, D. C., traces the cost of installing various combinations of gas and electric services in multiple housing projects. Making certain assumptions, it draws these comparisons and conclusions:

- "The cost of utility service for housing projects was computed at applicable rates in 35 typical communities. In every instance except one the cost of electricity in an all-electric project was higher than the total utility cost in the all-gas project. In the comparison of costs between the all-electric plan and the combination gas and electric plan the all-electric plan was substantially higher in every case.
- "It costs less to maintain gas appliances and equipment than comparable electrical facilities.
- "The electric heat pump has not performed as well as expected, nor has it demonstrated that it can compete economically with gas for heating in multiple housing projects."

These conclusions are based upon assumptions that many electrical industry spokesmen regard as unwarranted.

Comparisons in the report are drawn for three types of service combinations:

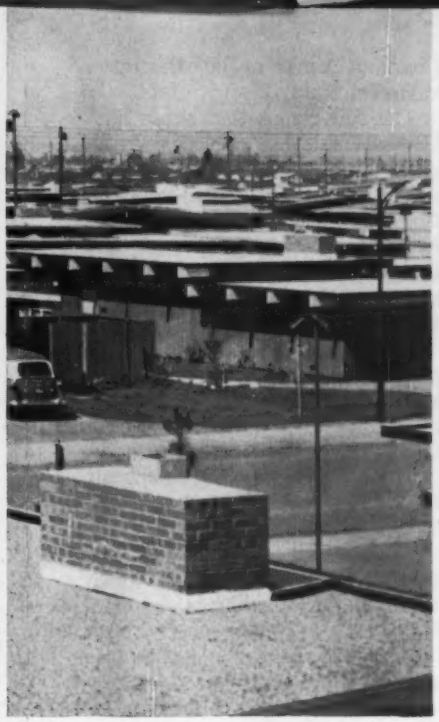
(1) All gas—This plan contemplates that gas will be used for the four major household tasks of cooking, water heating, space heating, and summer cooling. Electricity would be used only for lighting, small appliances, and refrigeration.

(2) Combination gas and electric—This is the same as the first plan except that a conventional air-cooled electric air conditioner will be used in place of gas for summer cooling.

(3) All-electric—Under this plan electricity will be used for all purposes, with an electric heat pump being used for space heating and summer cooling.

The Heart of the Matter

The heart of the Zinder report is a series of four tables labeled "Cost Comparisons." The first two



Living for Young Homemakers photo

It Mean?

tables, 1A and 1B, are headed "Demonstration of Computation of Comparative Utility Costs for 1,000-Unit Military Housing Project." 1A computes and compares the all-electric plan with the all-gas plan; 1B computes and compares the all-electric with the combination gas and electric. In both cases, the report shows the all-electric plan to be much more costly.

The second two tables, 2A and 2B are labelled "Computation for 35 Cities of Comparative Utility Costs." They are based, respectively on tables 1A and 1B, and upon another assumption, which, though clearly stated, may escape the reader's notice:

The operating cost comparisons for the 35 cities are based upon a hypothetical example of 3,500 deg-days and 1,000 hrs of cooling, not upon the actual conditions (other than rate schedules) in these communities.

This is where electric utilitymen have balked. Most spokesmen maintain that the hypothetical example oversimplifies the problem. They argue—and the Zinder report admits that other factors need to be examined—that other variables go into cost calculations. Says one long-time utility engineer and heat pump expert: "What about such factors as the interest on investment, amortization, maintenance and repair, ratchet clauses, trends in annual operating costs, taxes, intangible values, existing loads to which the housing load will be added and other like first costs?"

Tie Example to Locale

And another: "Hypothetical examples are sometimes dangerous, and even if justified, should be based on conditions applicable to each area. Let's make certain that all realize that a complete economic analysis is required in order to justify conclusions as to what service or services should be recommended."

But if electric utilitymen point out what they consider short-comings in the Zinder report, they do not for a minute underestimate its effectiveness and usefulness.

Nor do the gas men. Listen to Hal Springborn, executive editor of Gas Age magazine, editorializing in that magazine's Dec. 26, 1957 issue: "Readers are urged to refresh their memories by going back to pages 5, 6, 9, 49, and 50 of our September 19 issue, in which we discussed the amazing case of an all-electric choice at Little Rock Air Force Base (EW, Aug. 26, 1957, p 44). The Zinder report will help prevent any repetition of this mess."

'Put It to Work'

And a few lines later: "But the Zinder report won't be worth a penny if it rests in gas utility company files. It must be put to work.

"It answers with 'authentic and non-controversial' data the need for criteria in determining costs of gas and electric service in military and public housing projects. It would have prevented the LRAFB fiasco."

But what Gas Age—and the Zinder report—does not take note of in cases like the Little Rock Air Force Base "fiasco" was one basis for that decision, namely the narrowing gap between the cost of the therm and the kwhr. Although the gas utility could produce figures showing that lower operating costs with gas-electric would make up for the saving in initial installation realized by all-electric, the House of Representatives Subcommittee on Appropriations which conducted a hearing on the matter was impressed by the fact that gas rates in the Little Rock AFB area had risen better than 100% in the past eight years, while electric rates had risen only 3.4% during the previous 13 years. Said Air Force General J. E. Gill, who conducted the investigation for the AF, "It is not conceivable that this trend would reverse itself in the next 20 years."

The rise in the cost of gas relative to that of electricity is not limited to Arkansas. Generally, it is true all around the country.

Electrics Awakening

Electric utility interests are awakening to the challenge the Zinder report presents. The subcommittee on All-Electric Service to Capehart Housing of the Southeastern Electric Exchange Sales Section has taken on the jobs of (1) answering the Zinder report for the areas served by its member companies; and (2) preparing the positive all-electric story for them. Some of the details to be considered:

- Standard values for replacement of parts and units.
- Standard repair costs (For example, SEE might consider a figure something like $30 per year per unit for heat pump maintenance and repair.)
- Insulation costs and savings.

SEE's efforts are directed predominantly toward military and other government housing; the idea is to standardize and simplify values so as to be able to present to federal housing officials a common set of values for the areas served by its companies. The emphasis is on the *area* or *regional* approach.

Edison Electric Institute also is taking a place on the firing line. EEI's newly-formed Electric Housing Subcommittee is preparing an All-Electric Manual, which, although it will be designed for national use, will also present values and arguments on a regional basis. This manual, they say, is only the beginning.

Legal Moves Hit the West

San Diego argues on franchise taxes; Portland G&E is suing the Internal Revenue Service; co-ops and rates bring action

Franchise taxes, rates, and a breach of contract suit are among recent legal moves in the West.

The County of San Diego has filed a lawsuit for $228,165 in franchise taxes against the San Diego Gas & Electric Co for the period 1922 to 1946.

The suit is an outgrowth of a California Supreme Court decision last year. The court held the company should not have excluded San Diego, Coronado and National City from its franchise tax computations since 1947. The franchise tax is 2% of gross receipts.

In reversing decisions of two lower courts, the Supreme Court held the company was operating as a county-wide unified system and that the tax should be computed on all revenue. The earlier case covered the period since 1947 and resulted in a judgment of $188,000 plus $57,000 interest.

Now the county asks an additional $228,165.30—$186,529.75 on its electrical franchise from 1922 through 1946 and the rest on its gas franchise from 1935-1946.

IRS' Depreciation Rate Challenged

Portland General Electric Co is suing the Internal Revenue Service for $1,544,833 in tax refunds for payments made from 1948 through 1953. Main point of disagreement is on straight line depreciation rate.

PGE maintains the rate should be above 3% as a composite rate, not the 2.8% used by the IRS agent. The company depreciates on the basis of separate primary plant accounts.

Also at issue is $16,000 of legislative expense which was disallowed. Much of it was used to combat a Salem co-op's franchise election.

Colorado Central Power Co of Englewood has filed a $160,000 suit for damages in Federal District Court at Denver against the Intermountain Rural Electric Assn.

The suit claims that since 1955 Intermountain has reduced its purchase of power from Colorado Central in violation of a 1951 contract. Colorado Central constructed installations to provide the power, then the REA cut its purchase of electricity with resulting damages of $160,000, the suit alleges.

Pacific Gas & Electric Co is weighing its next move in a legal battle to get a review of the case involving the rates it charges Sierra Pacific Power Co.

The ninth circuit court of appeals in San Francisco recently refused to take jurisdiction and told PG&E to go back to the District of Columbia circuit court of appeals, which made an earlier ruling in the case. However, the deadline for filing with the District of Columbia court has elapsed.

PG&E is seeking a court order that would force the Federal Power Commission to review the case. The dispute arose when PG&E raised rates it charged Sierra Pacific, without the Nevada utility's consent. The dispute went to the U. S. Supreme Court, which ruled against the rate increase.

Copper Outlook Is for Price Upturn

Copper prices will make an upward swing as soon as "any substantial reversal" of the business slump occurs, said Roy H. Glover, Anaconda Co chairman, recently.

The price adjustments will be aimed at supporting "higher cost properties that have been curtailed or closed, and the resumption of normal operations in our fabricating plants," he said.

"Our industry is not in a bad situation" from a statistical standpoint, Glover said, because of the present low levels of inventories. A business upturn "should cause such a demand for our products as to result in prices" above today's level of about 25¢ a lb.

Glover gave his outlook before members of the International Union of Mine, Mill & Smelter Workers during its Denver convention.

GLOVER: Inventories on tail gates

The liquidation of copper inventories began in September 1956, or a year before most other industries.

Another factor in his expectation for increased demand is the growing use of copper by European fabricators.

In referring to the inventory situation in the U. S., Glover said, "Immediate delivery is now demanded of our fabricators on nearly all orders and, while numbers of orders have increased many fold over those received in days when our business was good, the quantities on each order are very much less. Many of our very important customers now freely say that their inventories are on the tail gates of our trucks."

Announced reductions in 1958 world production of copper now total about 275,000 tons, he said. The inventory liquidation in the U. S. has accounted for a decrease of 188,053 tons in deliveries to U. S. fabricators last year. Thus, Glover said, about 463,053 tons have been whittled back compared with year-end world stocks of 458,340 tons.

Kefauver Fires Tax Salvo

The Senate Judiciary Committee has released its report on use of rapid tax amortization by electric utilities, based on hearings last summer by its antitrust and monopoly subcommittee.

The report contains no recommendations, but Chairman Estes Kefauver (D-Tenn.) has written chairmen of House Ways and Means (Mills) and Senate Finance (Byrd) committees, notifying them of "revelations as to tax-free dividends flowing from accelerated amortization and liberalized depreciations by operating utilities."

The report also states:

- A survey undertaken by the Federal Power Commission at the subcommittee request "showed the vast extent of (property) acquisitions," reportedly made by utilities after receiving amortization benefits. The report adds that the subcommittee "heard testimony that some electric utilities used the cash generated by tax amortization to engage in predatory practices against their neighboring utilities, some of them cooperatives."
- Ebasco Services, Inc. and Idaho Power Co "knew of the award of the amortization certificates 12 days before it was made known to the general public," creating an "opportunity for stock speculation."
- Evidence of "White House interest . . . assumed special importance" in the issuance of certificates of necessity to Idaho Power for its Oxbow and Brownlee projects.

Sens Everett Dirksen (R-Ill.) and Alexander Wiley (R-Wis.) dissented from the majority report. Dirksen called it "a fantastic and transparent effort to put the tarred stick on American industry in connection with tax amortization in the belief that its application could establish favoritism by this administration in the issuance of such certificates, and to couple the program with acceleration of monopoly."

Wiley pointed out, "Although there was no conscious wrongdoing in high places in granting the Idaho Power certificate, serious consideration should be given to enactment of a statute which would prevent even the appearance of adverse interest in any government action with respect to applications by private companies, by providing that no former employee of such companies or their affiliates or representatives, could have anything to do with governmental consideration of those applications."

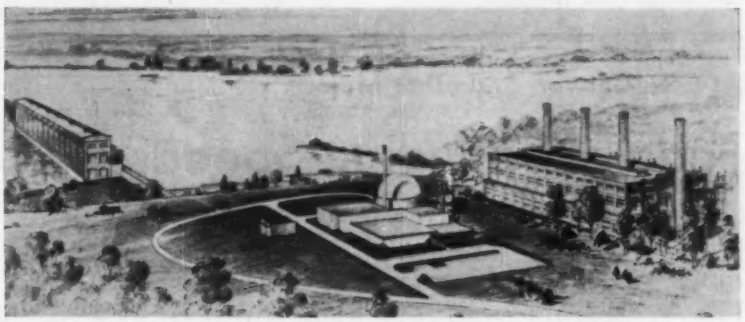
Another political snag for Idaho Power came when Oregon's Public Utility Commissioner denied an application for sale of $20 million in securities to finance Oxbow and Hells Canyon dams. The company said the action will not affect financing or continued dam construction.

Atomic Progress

A large Experimental Breeder Reactor will be built by Argonne National Laboratory at AEC's Idaho Falls testing site. AEC authorized $29.1 million for design and construction of EBR-2, which is scheduled for operation in 1960. An integral nuclear power plant, it will carry ratings of 62.5 Mw thermal and 17.5 Mw electrical.

ACF Industries' plan for Elk River boiling water reactor has been selected by AEC as a basis for contract negotiations. The Commission had invited second round bids last October on the 22-Mw plant for Rural Cooperative Power Association of Elk River, Minn., after AEC and original manufacturer didn't agree on ceiling price.

Windscale incident in Britain has resulted in third party claims totalling some $280,000. This includes cost of milk destroyed because of contamination with iodine-131, which spouted from plutonium production reactor stack.



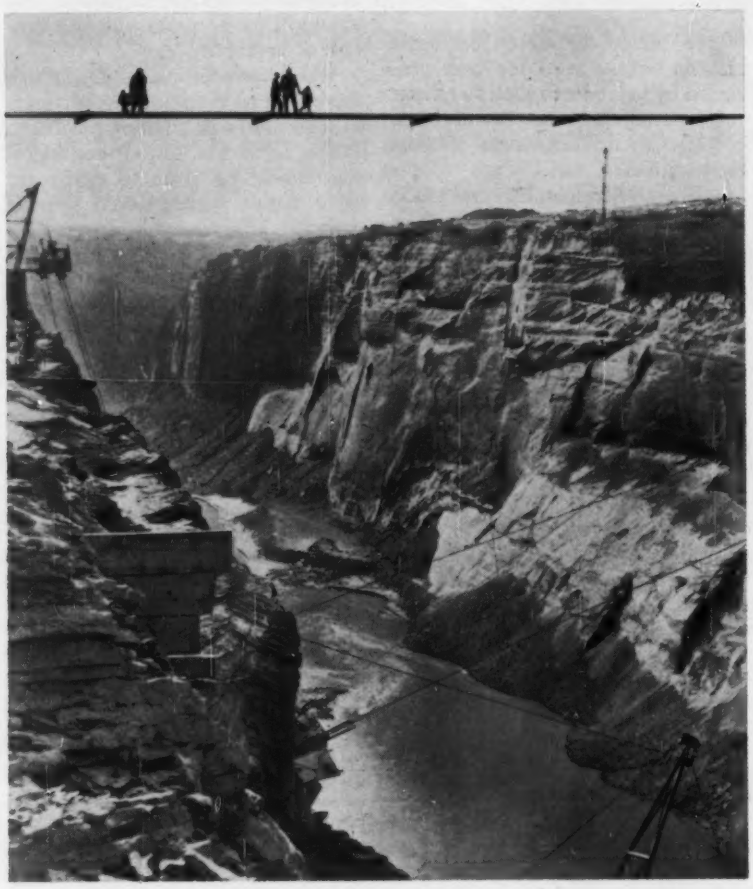
Want to Compare Generating Plants?

If you do, just go to Parr Shoals—about 25 mi NW of Columbia, S. C.—in 1962. That's when Carolinas Virginia Nuclear Power Associates expect their 19-Mw nuclear plant to go into operation.

The nuclear plant will be located between a hydroelectric plant and a conventional steam plant. This is believed to be the only place in the world where you will be able to see plants of the three different types located so close together.

Stone & Webster Engineering Corp will build the nuclear plant, which will consist of a pressure-tube type reactor, cooled and moderated by heavy water, and using slightly enriched uranium as fuel.

The hydro and steam plants both belong to South Carolina Electric & Gas. Co. They are rated 10 Mw and 80 Mw respectively.



At Glen Canyon and other projects . . .

Federal Spending Speeds Up

Power projects of the federal government will go ahead faster as the result of anti-recession moves in Washington. The Administration already has speeded construction of a score of multipurpose hydro developments by removing the brake on spending for the current fiscal year, ending June 30, and by asking nearly $200 million of additional construction money for Army Engineer and Reclamation projects this year and next.

Congress already has gone along with Administration requests for $10 million more to go at once to each of two reclamation projects where high-speed contractors had used up all available funds and had threatened immediate shutdowns. These projects are Glen Canyon Dam and power house on the Colorado River (above) and the Trinity River diversion in Northern California.

Increased Administration budgets for Engineer and Reclamation construction next year will go before the House Appropriations Committee as soon as the money group can get to them. Chairman Clarence Cannon (D-Mo.) had turned back the original budgets with orders that the agencies come up with "adequate" programs. Now he wants to hurry up the hearings on the enlarged requests. The committee will decide whether the upward revisions are "adequate."

Relocation Cost . . .

. . . would be set at 70% or less for federal liability under new legislation

The amount of utility relocation cost that the federal government will be liable for on future highway projects has been reduced in legislation ordered reported this week by the Senate Public Works Committee.

Under the new legislation by Sen Albert Gore (D-Tenn.)—yet to be acted on by the Senate and House—a top limit of 70% of the relocation cost is set as the amount the federal government may be liable for. Otherwise, on matching programs where the federal share is less than 70%, the utility relocation reimbursement can be no greater than the federal matching share.

Under the Highway Act of 1956, the states could call on the federal government to reimburse them for utility relocation up to 90% of the total cost. This applied where state laws required the state to reimburse utilities in whole or in part for the cost or relocating facilities as result of new highway construction.

The Administration has opposed any relocation reimbursement on the grounds that it wasn't taken into consideration in planning the interstate highway program and that any money diverted for relocation payments will cut down on the amount available for road construction. The Administration points out that in earlier contracts the utilities always have expressed willingness to pay any relocation costs in exchange for having access to the highways for servicing their facilities.

Meanwhile state resistance to joint use of right-of-way is growing. In Kentucky, for example, the state highway commission last week banned both overhead and underground utility lines along all limited-access routes. An existing order already shuts utilities out on the federal highway program. Reason given for the ban is the hazard presented by construction and maintenance crews parking trucks on road shoulders.

Chicago session gets down to cases on . . .

How Right-of-Way Cost Is Being Cut

Research, standardization, and more emphasis on education are methods now in use or coming soon, EW meeting reveals

By 1965 the total U. S. population will be about 193 million. A continuing move to the suburbs will find commuters pouring into larger cities from residential developments 100 miles or more away. In another eight years the value of U. S. farm lands could easily go from last year's $95 per acre average to $125 an acre, based on the increases experienced from 1949 to 1957.

These are three of the myriad developments that face the electric utility right-of-way man (see EW's survey on page 105). But these are the problems of tomorrow. Few of the R/W men who procure transmission routes and substation and plant sites are afforded the luxury of working on their utilities' needs beyond 1961.

It is this tight advance procurement period that compounds the R/W man's growing concern with the costs of acquiring space. Without ample negotiating time, procurement expense rises. With the construction department "coming over the hill," the pressure grows to break loose with the checkbook to close deals with "holdouts"—property owners reluctant to negotiate.

For those utilities, though, that have broken the barrier in advance lead time, the savings potential is impressive. This was one of the main points in the second national Right of Way Meeting sponsored by Electrical World. The two-day session took place in Chicago March 6-7, with 129 men attending.

For the cost-conscious registrants, Francis E. Manley, vice president of Orange and Rockland Utilities, Inc, told of approaches that are keeping R/W costs down in heavily congested portions of upper New Jersey. Negotiating takes place for land valued up to $3,000 to $5,000 an acre in heavier populated counties.

Manley follows these guidelines:

- Keeping abreast of municipal planners' plans.
- Close tabs on real estate and building activity.
- Contacts with committees or boards designing new zoning and planning ordinances to have specific provisions made for utility facilities.

"One of the techniques that we adopt . . . is a sales map along and for a reasonable distance on each side of a route," he said. "On this we show recent sales of property to determine general acreage values in the area."

For fair compensation, Manley has two of his experienced real estate men estimate independently the easement value over each property. The same is done by an outside realtor. The realtor, utility men and Manley then agree on an offer.

Besides these approaches, Manley's R/W operation has broadened recently to get research on "the actual dollar effect of sales of properties affected by easements." Besides benefits in making fair

STANDARDIZATION of R/W offers is suggested by Pres Charles H. Whitmore, Iowa-Illinois G&E. He's flanked by Murray Joslin, right, Commonwealth Ed VP

appraisals, help to negotiators, and helpfulness in future condemnations, the research has dispelled fears of a line devaluating nearby properties.

Luncheon speaker Charles H. Whitmore, president of Iowa-Illinois Gas & Electric Co, emphasized a four-point program on which top management must be sold:

1. Increased R/W planning—both long-range and project-by-project.
2. Education of the public, land developers, and local government authorities on the need for proper layout and dedication of R/W.
3. Standardization of easement or fee offers.
4. Training of R/W people on technical aspects and selling.

Area Standardization Seen

A standard approach to R/W is imperative within a single company for satisfactory dealings between agents and landowners, Whitmore said. Standardization eventually will transcend company limits, at least on an area basis, he opined.

Coordination with governmental units and local authorities is another area that can produce savings, said Richard H. Taylor, director of real estate and R/W, Detroit Edison Co. He described a $138,000 savings in the joint use of a street for an underground tie line that stemmed from "early and continued promotion of good liaison with city officials."

Detroit Ed recently assigned a man to visit various municipal clerks, managers and engineers. His job: "attempting to obtain information or complaints which would allow us to correct or revise an operating policy or furnish an explanation of the reason for the policy." Thus, the company will know in advance of creation or revision of a city charter, interim zoning or changes in enacted zoning ordinance, annexations, vacating of streets and alleys, Taylor said.

Taylor, who is also national chairman of American Right of Way Association, urged "extensive negotiation training to the end of better customer relations."

Land speculation is a thorn that can drain large portions of the R/W budget. Washington Water Power Co, a utility with all hydro capacity, has felt the sting increasingly, said its operating property agent, James L. Irwin.

Upon issuance of a Federal Power Commission license on Cabinet Gorge Dam, for instance, values increased 50 to 60% for lands at the dam site and reservoir, despite fast buying. Improvements increased from 100 to 200%.

For the upstream Noxon Rapids Dam, another 50% increase was paid for land, and improvements had increased another 100%.

Transmission easement prices, paid for on a structure basis, have trebled since 1940, he said, while farm lands have doubled. The disparity is due to farm mechanization, and larger holdings which require more center-of-the-field routes.

"More and more appraisers are doing research in an effort to ascertain in the market what actually was the effect of building a tower line." This was the gladdening news of Herman O. Walther, Chicago real estate appraiser and consultant.

"Professional appraisers realize that they must base their opinions on facts rather than belief," he said. A study of U. S. municipal airports indicates that "there is no adverse effect on residential property immediately adjacent," Walther said, adding that tower lines are not different from airports and other so-called nuisances.

Roy A. Strobeck, Commonwealth Edison Co's manager of real estate, told how teamwork with the engineering department pays off. The engineers are "sensitive to the expanding loads of our territory," and "have a good understanding of our R/W problems," he said. R/W needs are released well in advance of operating dates. "As a result," said Strobeck, "we . . . get our routes established and many times get in ahead of most land developments."

Ample time for planning and thorough preparation is a vital negotiating aid, he said. "We have at least one 'title analyst' backing up each field R/W agent." The analysts are part of the office "get-ready team," Strobeck explained, that conducts full research of every transmission line project.

The Risky Alternatives

Don Andrew, system supervisor, Real Estate and R/W for Indiana & Michigan Electric Co, told of alternatives facing utilities that are not planning for future R/W:

- Taking the chance that the R/W either won't be needed, or else railroad or other R/W will be available.
- Buying later on the assumption that possibly a cheaper dollar at that time will offset future costs.

"We are trying to plan well in advance," Andrew said, "and are acquiring rights now for known projects to 1961." For subsequent years, critical spots will be acquired by fee or easement.

Andrew cautioned of "a very real" danger of recent efforts to change laws of eminent domain.

TWO-PRONGED approach of AM sessions, PM roundtable discussions gave 129 registrants at EW's meeting an overall picture plus help on specific problems

"Such revisions may make it more difficult or impractical to condemn land, or interests in land, and finally perhaps make it impossible for electric utilities to exercise their right of eminent domain."

It might well be the fault of the utility itself when planning commissions and planners come up with tough restrictions, said Henry J. Sullivan, assistant to the president, Detroit Edison Co.

"Planners and planning commissions will react reasonably to the peculiar problems of an electric utility industry when they know the facts," said Sullivan, who is also president of the American Society of Planning Officials.

Zoning Guide Pays Off

He described Detroit Ed's 18-year old program of cooperating with planning and zoning agencies. Key relations tool has been a set of "utility zoning provisions," designed for private and public utilities.

"In almost all cases since their development, these provisions, when submitted, have been incorporated into zoning ordinances in our service area," Sullivan said.

The overhead-underground controversy requires a united front to educate city councils, zoners, planners, and the public, said William L. Deckman, attorney of Cleveland Electric Illuminating Co's real property section.

He gave the background on the company's controversy with Euclid, a small suburb outside Cleveland, that enacted an ordinance requiring anything above 33-kv to be built underground. A decision is expected next month on a mandamus action filed by the company to compel issuance of a construction permit for an overhead 132-kv line. If forced to go underground, the company will pay $3.5 million more than OH.

Availability to Determine R/W

Methods of pricing R/W will have to be refined, T. B. McAuliffe, superintendent of rights of way, Duquesne Light Co, said. And system planners will have to give thought to purchasing R/W and distribution center sites based on availability of land rather than load requirements. The federal highway program is establishing a new set of land values he noted, which will have an impact on each R/W man.

Utilities will have to decide on the easement vs. fee question in the immediate future, McAuliffe predicted.

A pro-fee position was taken by R. L. Bortner, manager of Potomac Electric Power Co's real estate department. Pepco uses a "qualified fee title" which "reserves to the property owner . . . the easements of crossing the strip and of using it for agricultural purposes," he said.

When subdivisions develop, purchasers of land next to the R/W automatically acquire rights for the width of property extending to the center of strip. Costs for the qualified fee title on 38 mi of land already acquired have been no greater than "we would pay for easements and, in some cases, we think it has saved us some money," Bortner said.

Despite added legal, survey and detail work, there are advantages in working through the Massachusetts Department of Public Utilities for R/W and sites, said James G. Smith, Chief R/W Engineer, New England Gas & Electric Association. Petitions are presented for necessity and convenience, and for survey preliminary to condemnation. The DPU is also petitioned later for exemption from town zoning and eminent domain authority.

"Knowing in advance that we are going to the DPU with eminent domain proceedings, we do not have to consider or accede to insistent, unreasonable requests of property owners to relocate . . . and we do not have to consider paying premium prices . . ." Smith said.

Training Program Needs Outlined

On training, W. F. Hutchinson, special representative of Iowa Southern Utilities Co, suggested appointment of assistant district managers in charge of public relations on R/W acquisition and line building.

He recommended that training include background information about people with whom the new agent will deal, engineering and technical matters, and on equitable treatment.

From an attorney's standpoint, the new man needs basic property law know-how, an understanding of the easement document, and must know the importance of keeping complete, accurate notes. So said Attorney Charles R. S. Anderson, special representative, also of Iowa Southern.

The new man needs "the ability to read and comprehend legal documents and land descriptions," he stressed.

Land and R/W acquisition and management have changed from a "relatively simple to a most complex operation," said Cullen W. Coates, title section supervisor, Pacific Gas & Electric Co. The aim of an integrated R/W operation "should produce personnel trained and qualified to perform all of the complex functions" that result in better planning and advance acquisition of land and R/W, he said.

Told Shippingport Reactor Shutdown Features

PEA Systems Operation meeting hears initial tests cover shutdown, startup and load-change operations of reactor

Progress report on testing of the Shippingport pressurized water reactor and on the four main problems facing designers of the Pennsylvania advanced reactor project provided a full meeting for Systems Operation Committee of Pennsylvania Electric Association, Feb. 6-7 in Pittsburgh, Pa.

Roger E. Martin, Duquesne Light Co, presented these preliminary conclusions on Shippingport:

1. Plant can be shutdown overnight with operating temperatures maintained near normal (523F primary coolant) through intermittent operation of main coolant pumps. During shutdown, control rods are inserted to stop fission.

2. Start-up from hot condition can be made in about 1½ hr, of which 30 min are needed to bring reactor critical.

3. Apparently, reactor power output follows all but largest load changes without immediate control-rod movement, due to negative temperature coefficient of reactivity.

Needs Less Attention

Two instances were cited by Martin to illustrate that operation of a reactor during severe load transients requires much less attention than a conventional coal-fired boiler. In one case, station load was decreased from 44 Mw to about zero in a single step over several seconds. Average reactor coolant temperature rose from 523F to 529F, but returned to normal with no control-rod motion necessary.

In the second case, turbine throttles were tripped closed with 60 Mw (full net load) on the unit. Although steam flow to turbine stopped, reactor power was reduced automatically and fast enough to obviate either primary or secondary relief valve operation. One control-rod group inserted several inches to correct coolant temperature; normal reactor coolant temperature and pressure were restored immediately.

Based on completion of half of the initial 140 tests at Shippingport, it is believed that 5,000 hr of equivalent full-power output can be obtained from a single core, a 67% increase over initial hopes. A second and larger core under construction may raise net electrical output from 60 to 100 Mw and provide a longer equivalent life. Existing auxiliaries, which take 7 to 8 Mw at 60 Mw net electrical output, are sized for the larger core. To make Shippingport fully automatic, Martin suggested that improvements will be necessary in conventional instrumentation.

4 Problems in PAR Design

Four main problems to be overcome in designing the aqueous homogenous reactor (PAR), said S. C. Townsend, Pennsylvania Power & Light Co, are catalyst reaction in the gas recombination system, ionic stress-corrosion cracking of stainless steel, handling of slurry, and hydraulic characteristics in the pressure vessel.

Most trouble is experienced in the gas recombination system. A suitable catalyst is needed to recombine D_2O_2 from the primary system into D_2O for re-use. Chloride, fluoride, or bromide ions cause stress-corrosion cracking in the primary reactor loop piping. Under test are schedule 304 and 407 stainless steels, and other new materials still in the laboratory stage.

Hard on Pumping Systems

Slurries of thorium-uranium oxide, plus poisonous and corrosive materials, are very hard on the pumping systems, said Townsend. Over 200 types of materials have been tested. Through use of the hot-products process, it is hoped to cut the decay-cooling time of irridated slurries (Th, Pg, U and fission products) from 120 to 4 days.

In the past two and a half years, $5.75 million has been spent on research and development, and another $7 million will be spent by 1959. Sights are set on a completion date of December, 1963, for PAR, which includes a four-year construction time. Townsend said that on a 1:1 breeding ratio and an 80% operating factor, a 150-Mw plant might require $4,000 of fuel annually.

Utility Construction Boom Forges Ahead

Plans for expansion by the electric utility industry continues as the bright spot in U. S. capital expenditure programming for 1958 (EW, March 17, p 60).

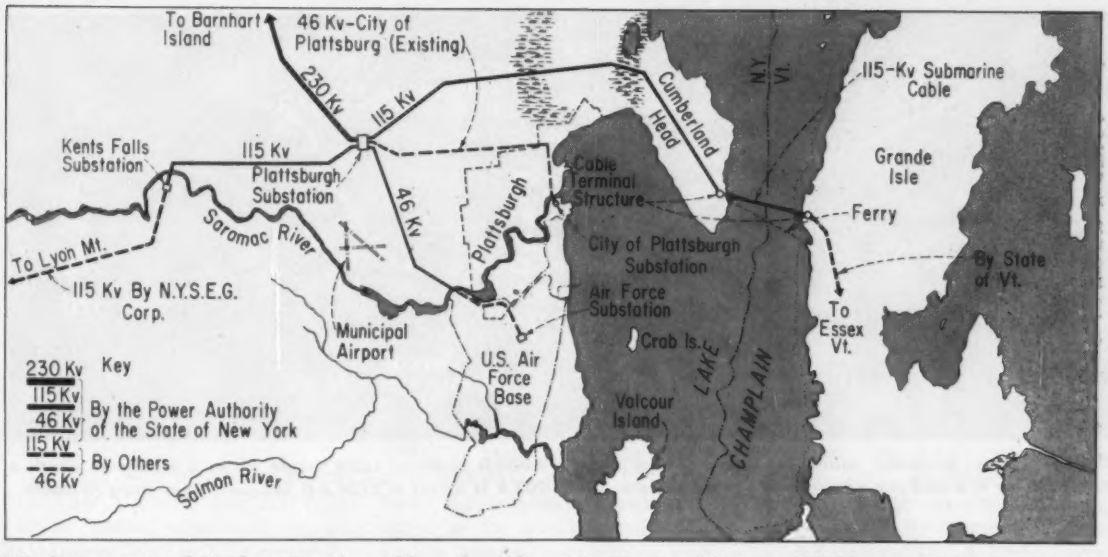
The record-breaking construction program of the power industry will see about a 10.5% increase over 1957's outlay of $4.7 billion. Items:

Louisville Gas & Electric Co plans to build another $20-million generating unit at its Cane Run Power Plant. The unit is similar to one now being built there, which will be operating this summer. Both are 125,000-kw turbo-generators.

Monongahela Power Co plans to spend $50 million in the next three years for expanded facilities. Half the sum will go for a new generating unit at Willow Island Station over the next three years with $8 million planned for each of the three years. Each unit will turn out 165,000 kw. Another 1958 project is a new power line connecting Rivesville and Willow Island generating plants to cost estimated $2.4 million.

Montana-Dakota Utilities has announced a $10½-million construction budget for 1958, largest in the company's history. About $5,950,000 is earmarked for Montana work. Largest item in the budget

(*Continued on page* 96)



MAP shows route of 115-kv submarine cable under Lake Champlain linking Cumberland Head, N. Y., and Grande Isle, Vt., for delivering 100,000 kw of firm St. Lawrence power to Vermont and 40,000 kw to the Plattsburgh area

115-Kv Cable to Cross Champlain

St. Lawrence Project power to reach Vermont via submarine extension on lake's bottom

R. E. MORAN, Electrical Engineer, Uhl, Hall & Rich,* Boston, Mass.

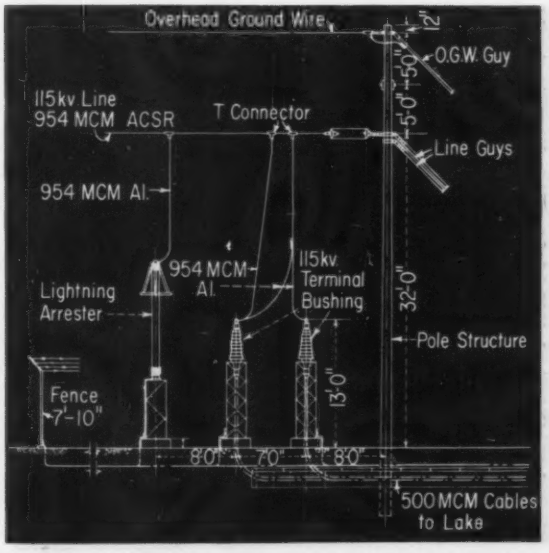
Construction of a 9,000-ft submarine cable across Lake Champlain is scheduled to begin this spring. The cable, a low-pressure-oil, self-contained, single-conductor type operating at 115 kv, is planned as an adjunct of the St. Lawrence Power Project which is nearing completion.

Field surveys have been completed for this important transmission link between the Power Authority of the State of New York and the new Vermont Electric Power Co, Inc. The installation, connecting the Authority's Plattsburgh Substation with VELCO's Essex Substation, near Burlington, Vt., will deliver 100,000 kw of firm power to Vermont. The transmission line feeding it also carries 40,000 kw for the City of Plattsburgh and the U. S. Air Force Base situated there. Most of the Vermont allotment will be delivered at the Burlington area.

As Lake Champlain is some 20 miles wide between the cities, a transmission line around the lake would be about 100 miles longer than one on a direct route. But it was found that a narrow channel (about 7,500 ft at its narrowest) between Cumberland Head, N. Y., and Grande Isle, Vt., could be crossed by a submarine cable, and the terrain between Grande Isle and Burlington would permit conventional overhead construction. A profile of the channel bottom showed it to be rocky and suitable for a cable installation.

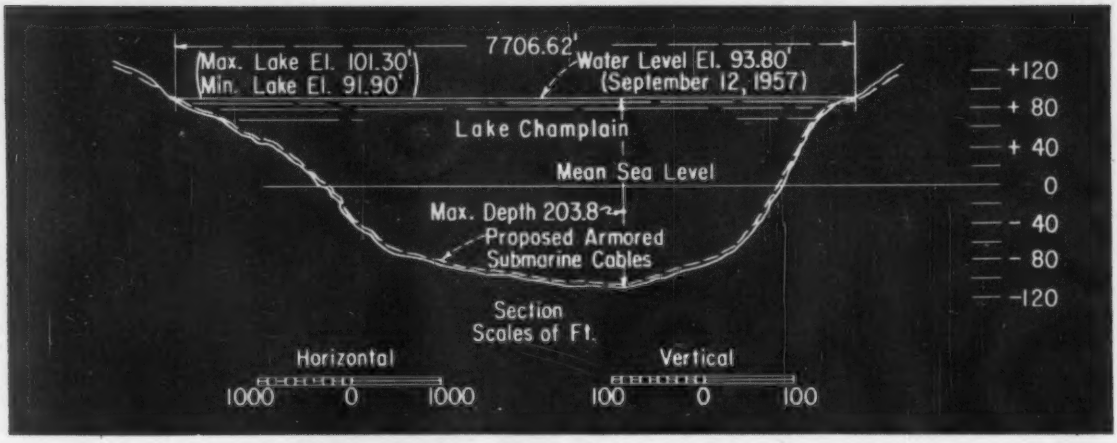
Four types of submarine cable were considered for operation at the 115-kv level. These were:

1. Low-pressure-oil, self-contained single-conductor
2. High-pressure-gas (200 lb), self-contained, single-conductor
3. High-pressure-oil, three-conductor, pipe-type, and



TERMINAL EQUIPMENT, as shown, would be used at both shore ends, at Cumberland Head, N. Y., and Grand Isle, Vt.

* Engineers to the Power Authority of the State of New York, and partner affiliate of Chas. T. Main, Inc.

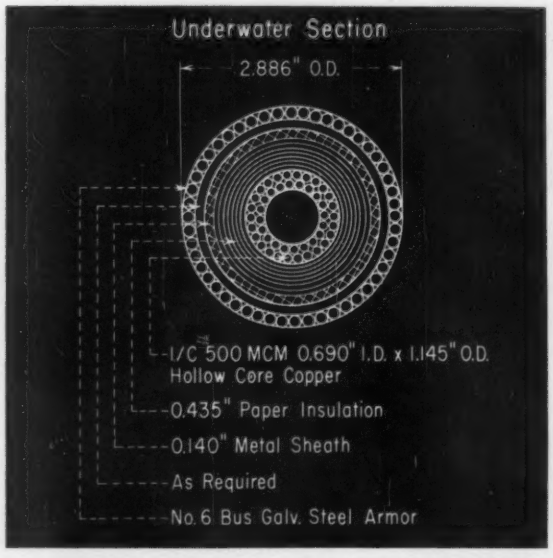


SECTION shows proposed submarine cable across Lake Champlain as it would lay on the lake's rocky bottom. The 9,000-ft armored cable would be at a maximum depth of 203.8 ft across a 7706.6-ft channel, from shore to shore

4. High-pressure-gas, three-conductor, pipe-type.

A study of submarine-cable failures, revealed that no faults were traceable to electrical failure; that most recorded faults resulted from external damage to the conductor. Ships' anchors were the usual cause of damage. As Lake Champlain traffic in the vicinity of the cable is largely small, pleasure craft, there could be no real danger from ships' anchors.

As the submarine cable's service requirement will be high, Vermont engineers considered a single, three-conductor circuit not reliable enough for this installation. Accordingly, the installation will consist of four cables connected to form one 3-phase circuit, but all cables will be energized. Removal of jumper connections at the cable terminals will remove any single faulted conductor and restore service within a short time. It is expected that a faulted cable could then be underrun, when necessary, and repaired without serious service interruption.



CONDUCTORS are 500 MCM copper, constructed with hollow central core 690 mils dia. Paper tape is .435 in. thick

The 3-phase circuit will be rated 125,000 kva. The four single conductors will be of 500 MCM copper, having a hollow central core of 690 mils diameter. Around the conductor, oil-impregnated paper tapes will be wound helically and evenly to an average thickness of not less than .435 in. A No. 6 BWG steel armor will surround the underwater section. Overall diameter of the cable will be 2.886 in.

The armor will be terminated and grounded at each shore, and the cable will be buried from the lake edge to the cable terminal, a distance of some 600 ft on the New York side and about 300 ft on Grande Isle. The steel armor will be removed from the buried section to reduce heating by induced currents, and an extra 38-mil layer of Neoprene sheath will be added as an outside covering. Each conductor will be in a separate trench, backfilled with well tamped sand and covered with a protective slab of dense concrete.

Completion Slated for Late 1958

The cable will be manufactured in four single, 9,000-ft lengths, the Neoprene sheath being installed during manufacture underneath the steel armor over a length of 1,000 ft at each end of the cable. No galvanic protection is contemplated. It is planned to ship the cable mounted on four separate reels on a barge equipped for installation. All conductors will enter the water simultanously, the separation between each being about 6 ft.

Two 15-gal reservoirs at each cable terminal for each conductor will maintain a positive oil pressure of 21 psig within the cables at the shore. These reservoirs will be 52.5 ft above the mean low-water elevation.

By the end of 1958, construction of transmission facilities by the Power Authority of the State of New York, Vermont Electric Power Co, Inc., Niagara Mohawk Power Corp, and the New York State Electric & Gas Corp will be completed and interconnected to provide a dependable delivery of 100,000 kw of firm St. Lawrence power for the rural and domestic customers of the State of Vermont.

In small horsepower range . . .

Cheap Speed Control Possible

Varying the motor terminal voltage provides relatively inexpensive speed control without introducing instability

D. W. HUSZAGH, Associate Engr, Mech Engr Division, Brookhaven National Laboratory, Upton, New York

Speed control can be obtained with small horsepower, high slip (Nema Class D), induction motors by the simple and relatively inexpensive method of varying the motor terminal voltage.

This has been confirmed in tests on a 3 HP, 3 phase, 440/220 v, induction motor conducted at the Brookhaven National Laboratory.

Tests showed that the motor operated in a stable condition, the problems of increased motor heating could be solved, and the speed was proportional to terminal voltage.

Adjustable speed induction motor operation was investigated at the Laboratory because it was difficult to find suitable throttle valves for high temperature liquid bismuth service used in reactor experiments. Brush motors were ruled out because hermetically sealed motor pump combinations had to be used and this type construction prevented any maintenance—a necessity with brush motors. Also eliminated from consideration were:

1. Standard induction motor and frequency changer combination—high first cost.

2. Multispeed induction motor—limited to four fixed speeds.

3. Low slip induction motors with adjustable motor terminal voltage—characteristics are not as good as high slip motors which offer the advantages of inherent greater current limiting at high slips, and absence of a torque breakdown point.

In the tests the 3 HP motor was belted to a dc shunt generator. Load on the generator consisted of lamps in parallel. This type of load on the motor is quite similar to the load of a centrifugal pump. For in both cases the required horsepower reduces as the speed is reduced. In reality however a generator load is far more severe than a pump load.

Motor terminal voltage was adjusted by inserting resistance in series with the motor phase leads.

Two types of test runs were made. In the first, called "pump like runs", line voltage was impressed on the motor terminals and the load was increased until the motor current rose to an arbitrarily selected valve. Motor voltage was then successively reduced. Voltage, current, and speed readings were taken at each stage of voltage reduction.

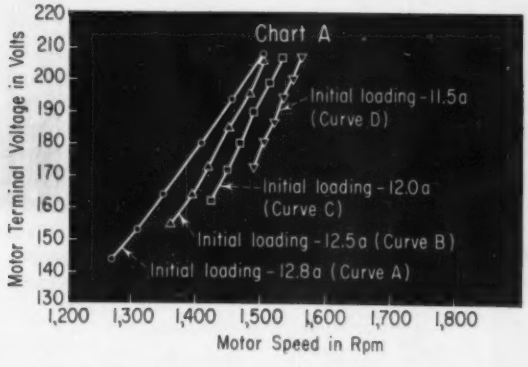
In the second type of runs, labeled "constant load and overload", attempt was made to re-establish the initial load after each successive motor voltage reduction. This was accomplished by increasing the generator field excitation to compensate for the reduced speed.

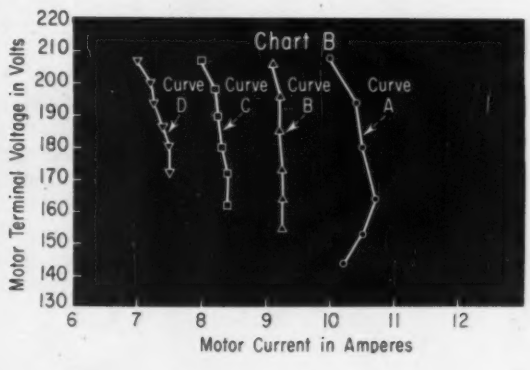
Results for the "pump-like runs" are shown in the charts below.

It can be seen (Chart A) that within the voltage range obtainable, the speed changed linearly in proportion to the change in voltage regardless of the initial loading. The rate of change of speed with respect to voltage appears to be slightly larger for high initial loads.

The slight steady increase in motor current with a decrease in terminal voltage and speed suggests that motor heat output increased slightly (Chart B). As the integral motor cooling fan operates at progressively reduced capacities as motor speed diminishes, auxiliary cooling means are required to remove motor heat when operating at reduced speeds. A heat removal system capable of removing a heat equivalent of 25% of rated motor HP should be adequate for centrifugal pump drive duty, because motor current should not rise at reduced speeds in this service.

In the "constant load and overload" runs, an attempt was made to cause the motor to become unstable due to excessive overload. The motor did not become unstable in spite of the parasitic effect of the voltage dropping resistors, but speed regulation became very poor at substantial overloads. Linearity of both the motor speed curves and volt-ampere input curves (not shown) indicate that the motor was operating in a stable condition. Because the power requirement per unit of speed reduction should be even less with centrifugal pump load, this type motor should operate successfully at substantially reduced voltages and speeds as a centrifugal pump prime mover.





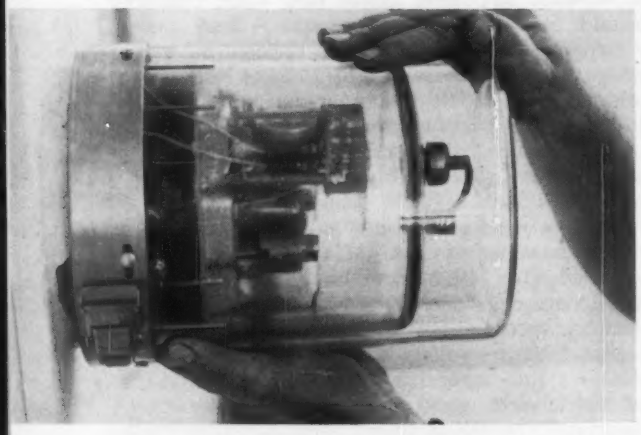
Cutter Mounted on Crawler Tractor

A tractor-mounted cutter provided crews of Community Public Service Co with a tool to clear right-of-way for a 66-kv line through stands of pecan trees in Brazoria County, Texas. The crossville cutter, mounted on a crawler tractor, plowed through thick stands of trees along the San Bernard River.

The cutter is a large serrated blade which extends before the tractor like a cowcatcher and cuts through tall trees "as a knife might cut through warm butter," says Mrs. Ruth Steinhauser, director of public relations for Community Public Service.

The tractor operator is protected from falling trees by a metal canopy. Thus the tractor may be moved ahead letting the timber fall where it may.

Sequence of the operation is something like this. The cutter moves into action against a towering tree which gives way and falls across the cutter. The tree is rolled from



Plastic Protector Prevents

R. O. BUSHNELL, Meter Supt, Miami Area, Florida Power & Light Co, Miami, Fla.

A protector for holding socket-type meters during installation and removal, developed by Florida Power & Light Co, prevents personal injuries from broken glass and damage to meters.

The meter protector, made of clear plastic (Butyrate

Adjustable Aluminum Clamp Safely

A new type of clamp for grounding lines safely while work is being done on them or equipment has been developed by Carolina Power & Light Co. The all-welded aluminum clamp has an adjustable jaw attached to a threaded rod which, in turn, is secured to a hot stick. A ground conductor is welded directly to the body of the aluminum clamp.

Chief advantages of the clamp are its flexibility and ease in handling. It can be tightened securely on all sizes of conductor from No. 10 copper to 556.5-MCM ACSR over armor rods. Relative softness of the aluminum jaws minimizes nicking and scarring of conductor.

Need for the clamp stems from use of ACSR, which is considerably larger than equivalent copper conductors. These larger conductors were being grounded in an indirect manner because of the lack of an adequate size clamp. Direct clamping on the conductor provides a safer and more-positive ground.

Clears Right-of-Way

the canopy as other trees strike it in falling.

Cleanup of the brush is handled with a power rake, which fastens on a tractor like a bulldozer arrangement. The rake follows the cutter, stacking the timber as it goes. The operation is fast, efficient, and leaves a neat right-of-way.

Injury from Broken Meter Canopies

Tenite-2), is simply an oversized meter cover. It is secured quickly and easily around the meter base by a stainless steel band using a compression catch.

The device prevents injuries that can occur if the glass meter cover breaks during handling. It is particularly valuable when removing socket-type meters having broken canopies. The holder also offers protection from short circuits caused by strain on the terminals.

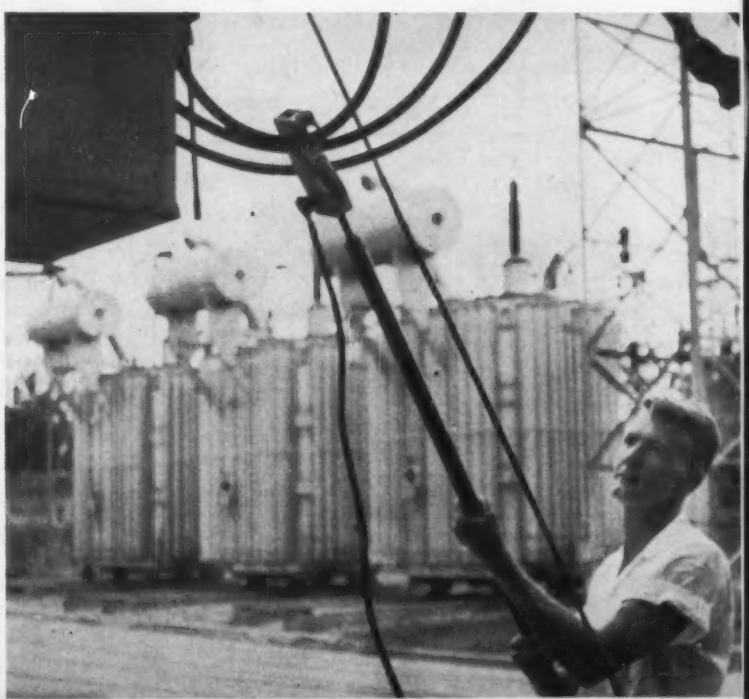
In addition, the protector simplifies the job of inserting and removing meters, as well as prevents damage to the meter.

Originally, three protectors were built by the company for experimental purposes. After some improvements, 24 more units were made. They proved so satisfactory during the trial year that the company now has 100 meter holders in use.

Grounds Conductors

Experience with these new clamps has been so good that 50 have been fabricated in the shop and distributed to the crews.

The aluminum clamp was developed by Wallace Gardner, line performance analyst, who conceived the original idea; and Roy Howard, line foreman, who refined the design.

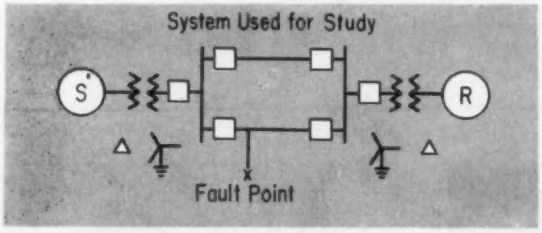


Evaluation of System Transient Stability Requires Consideration

B. L. LLOYD and C. A. DESALVO, Electric Utility Engineers, Westinghouse Electric Corp, East Pittsburgh, Pa.

Most important criteria for determining whether a system will show satisfactory transient stability, plus suggested conditions which should be used, are:

1. Severity and type of assumed disturbance. A 3-phase fault at a critical location should be used.
2. Operation of protective equipment. An additional contingency should be assumed, such as failure of first-line relaying or unsuccessful reclosure of faulted line.
3. System conditions preceding the disturbance. Stability studies should be based on the load level (heavy or light) which results in the more critical case. All transmission equipment should be assumed to be in service, with one generator down if this substantially produces the stability limits of the system.



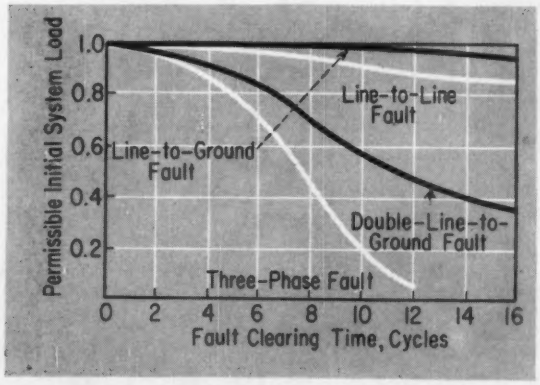


FIG 1—TRANSIENT STABILITY LIMITS vary with different types of faults. Three-phase faults are the easiest to analyze and usually are the most severe disturbance

These test conditions reflect a basically conservative philosophy. They may be criticized as being too severe. In general, a disturbance of extreme severity may seem unreasonable because of the low probability of its occurrence simultaneously with the additional contingency selected. The assumed conditions probably may never occur; however another set of conditions, almost as bad, probably will occur. Thus, it is desirable to pick conditions severe enough so that even if they do not occur, the test of stability will demonstrate the capability of the system to ride through unforseen emergency conditions which probably will occur.

Severe Criteria Justified

This conservative philosophy is borne out by outages and emergency conditions on utility systems over the past few years. Almost all cases were traced to a combination of circumstances which, considered alone, would seem to be unreasonably severe criterion. These include loss of an entire large station, permanent multiple-circuit faults, operator errors during or following a severe system shock, repeated testing into a faulted bus, severe faults with circuits out of service, and unexpected trouble on interconnections. These "extremely unusual" combinations have occurred sufficiently often to justify use of very severe criteria for system design.

Almost any practical power system will exhibit transient instability if the assumed disturbance is sufficiently severe. In some cases, switching operations or sudden large load changes can result in critical stability conditions. More frequently, the most severe test of transient stability will be faults on the transmission system, which occur relatively often. Thus, it is proper to select faults, rather than other disturbances, as design criteria.

What severity of fault to assume is the next decision. About 70% of all transmission line faults are line-to-ground, about 5% are three-phase, and the remainder is about equally split between line-to-line and double-

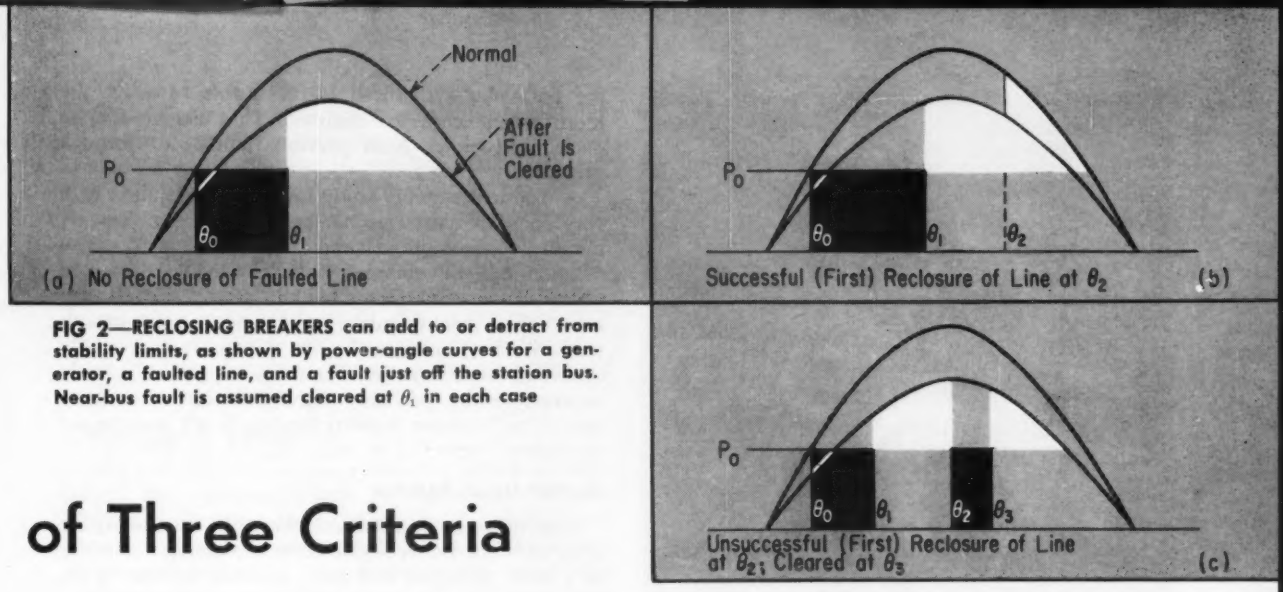


FIG 2—RECLOSING BREAKERS can add to or detract from stability limits, as shown by power-angle curves for a generator, a faulted line, and a fault just off the station bus. Near-bus fault is assumed cleared at θ_1 in each case

# of Three Criteria

line-to-ground faults. In spite of the relative infrequency of three-phase faults, this type is most generally used for stability studies. It is the simplest type to analyze and it is usually the most severe. Comparison of the effect of the various types of faults on the stability limits of a system is made in Fig 1.

Use of the three-phase fault criterion has sufficient merit to justify its use. However, the planner must consider other assumptions in this area. On double-circuit lines, should only one or both circuits be faulted? Some companies consider the reliability of double-circuit lines almost as that of two separate lines. Some consider that both circuits can be out for rating firm transmission capability, but make stability calculations for faults on only one line. Others have made stability studies with simultaneous three-phase faults assumed on both circuits. It may not be economically feasible to design a system on the basis of severe double-circuit faults on double-circuit lines. Nevertheless, it is desirable to make some studies with these severe fault conditions to develop a better feel for possible problems.

The next important decision is the assumed operation of protective equipment. Relay and circuit breaker characteristics can be used to determine fault-clearing time, assuming all protective equipment operates properly. However, protective equipment does occasionally operate in an incorrect or undesirable manner; perhaps 3-5% of operations may involve some failure, such as equipment failure, faulty wiring, or misapplication.

An assumption must be made whether the fault will be cleared by first-line or by back-up relaying. Modern relays and breakers will allow fault-clearing in 4-6 cycles on first-line protection, with back-up protection requiring 15-25 cycles. The stability limit obviously is quite dependent on the assumption of whether first-line or back-up protection clears the fault.

High-voltage breakers often are arranged for automatic reclosing following a tripping due to a fault. About 80-85% of the first instantaneous reclosures usually will be successful; another 10% will stay in on the second reclosure; perhaps 5% will result in lockout. High-speed reclosing will increase stability limits so long as the first reclosure is successful. However, an unsuccessful reclosure results in a much more severe transient condition, as illustrated in Fig 2.

Transient Condition Analyzed

Power-angle curves are shown in Fig 2(a) for a generator under normal conditions and with a faulted line out of service. The generator operates at an initial load of P_o and an angle θ_o. Assume a three-phase fault just off the station bus and neglect losses. For this

Why Transient Stability Should Be Re-Evaluated

Many power systems today have smaller margins than ever before between normal operating conditions and transient stability limits. This follows from constant efforts to decrease operating costs. The search for economy has resulted in larger concentrations of power in single generating stations and heavier transmission circuit loadings. The problems of analyzing and evaluating system transient swings are also becoming more complex because of the trend to establish and make maximum use of inter-company ties. These aspects of system design and operations require a continuing, careful evaluation of the criteria used for judging the transient performance of a system.

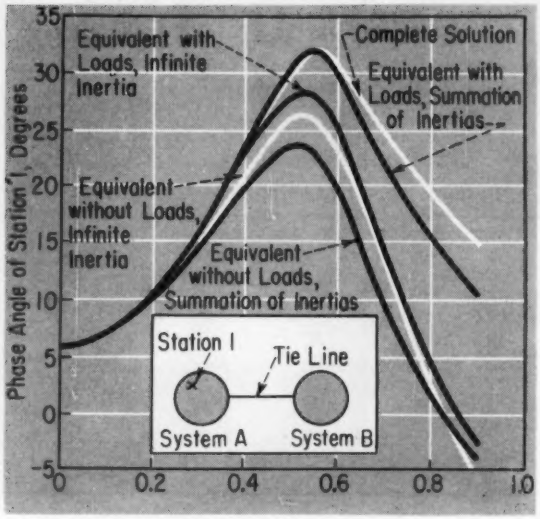


FIG 3—TIE-LINE EQUIVALENTS are developed for a two-system problem with one tie line. Swing curves for only one station located in system A are plotted

condition the generator power drops to zero. Using the equal-area criterion, the fault can persist until the angle swings from θ_o to θ_1 without losing stability, so long as the faulted line is not reclosed.

If an immediate reclosure is made successfully, the fault can be left on for a longer time until the angle swings to the new θ_1 in Fig 2(b). If the first reclosure is unsuccessful, the permissible clearing time is shorter than in the first case where reclosure was not attempted. An unsuccessful reclosure of the faulted line is illustrated in Fig 2(c).

It follows from a study of Fig 2 that for the instantaneous reclosing breaker the stability limits can be either greater or less than the limits without reclosing, depending upon whether the reclosure is successful. In setting up the criterion for satisfactory performance, the planner must assume either successful or unsuccessful reclosure of the breaker.

Investigate Load Conditions

Two decisions must be made concerning system operating conditions at the time of the fault. A very important decision concerns the amount of equipment assumed to be out of service. Experience with companies using the ac network calculator indicates that large generating units, often are assumed to be out of service if this results in a more severe stability condition. However, major transmission circuits seldom are assumed out of service unless extended outages of lines are planned. These assumptions seem reasonable. However, assuming a unit out of service may give a more or less critical condition, depending on the particular case.

Before the initial set-up is made, use of a maximum or minimum load condition should be investigated. Either case may prove the more critical depending on the particular system. It is reasonable to select the more critical case for analysis. This usually can be determined either from previous studies or through preliminary studies.

A transient stability study involves the solution of a very complex electromechanical transient problem. A number of assumptions simplify the problem so that a solution can be obtained with reasonable time and effort. Some assumptions tend to give pessimistic results; others give optimistic results and, to some extent, tend to offset errors in the first group. It is generally conceded that conventional assumptions give sufficiently accurate results, probably slightly on the conservative side. ("In Transient Stability Studies, Don't Squeeze out the Safety Factor," EW, Aug. 12, '57, pg 85-86.)

Do Not Upset Balance

Sometimes assumptions are altered by accounting for a variable previously neglected or evaluating a quantity in a more elaborate and more accurate fashion. Care must be used not to upset the approximate balance, which presumably now exists between optimistic and pessimistic simplifications, by making refinements all in one direction. For example, it would hardly seem fair to claim the benefits of fast voltage regulator action, fast governor action, and the decelerating effect of dc losses without also considering that some system loads are almost constant-current rather than constant-impedance and thus have a more adverse effect on stability than is assumed.

The tendency to evaluate one of the pessimistic factors more accurately is particularly strong when a study has just shown that the present system is "almost stable." If some of the factors are evaluated in more detail, it could be determined with greater certainty that the results are merely "less conservative" and do not become "more optimistic."

In addition to the above criteria, further decisions to be made include the representation of interconnected systems, which is of increasing importance. The development of an accurate equivalent of a neighboring interconnected system can be very complex. If ties are fairly symmetrical with respect to all major stations in the adjacent system, a single-machine equivalent may be derived which will satisfactorily represent that system during a stability study. In the more typical case however, some stations in the neighboring system will appear electrically near, with others quite remote. For swings following a severe fault, stations in the adjacent system may not swing together, and the stations cannot be represented accurately by a single-machine equivalent. In this case, it probably will be necessary to maintain the identity of the nearby stations and set them up in detail on the board. The equivalent then would be formed deeper into the adjacent power system.

Assign Sum of Inertias

When a single-machine equivalent is formed, either at tie points or within the system, the equivalent generally should have an inertia assigned to it which is the sum of the inertias of the machines which go into the equivalent. If the inertia is assumed to be infinite, results usually are pessimistic. They may be so pessimistic as to present a considerably distorted picture. The equivalent circuit should also include the presence

of loads on the adjacent power company system.

In Fig 3 are shown the results of a study to develop interconnection equivalents for a sample two-system problem with one tie line. A stability study was made first with the two systems represented in detail, then with various equivalent circuits. Either omitting loads or assuming infinite inertia in the equivalent causes considerable error in the results. The single-machine equivalent which includes loads and assumes finite inertia gives quite good results. Swing curves of only one station are plotted in Fig 3; however, relative positions of curves for other stations in the interconnected system are very similar.

General Rules Applicable

For multiple ties and more complex system arrangements, the equivalent circuit can become much more elaborate. However, the general rules of including reasonable system loads and an inertia approximately equal to the sum of inertias of machines in the equivalents still will result generally in more appropriate equivalents.

There are some cases where use of infinite inertia and neglecting of loads in the adjacent system are justified. This may be the case where the system being studied is connected into a much larger system, or where the tie is quite weak and the synchronizing power over the tie is quite small compared to machine accelerating powers during faults. However, even in cases where a system is tied into a very large power pool, it may be necessary to set up nearby stations in detail. They may swing with the system being studied rather than with the remainder of the pool.

One transient condition which merits special mention is loss of excitation on a large generator. System stability often is investigated for loss of the unit but is seldom investigated for loss of excitation. Whereas a system fault involves very rapid changes in system conditions, loss-of-field results in changes which occur much more gradually. Nevertheless, a loss-of-field condition can have a more adverse effect on the system than does complete loss of the unit.

This is due primarily to the large amount of reactive which must be supplied to the unit when it is running as an induction generator. This reactive may be equal to the nameplate kva of the generator; the displacement in reactive can be much greater than this if the unit was supplying appreciable reactive before the disturbance. Systems are almost always designed for loss of any unit, but they may not so readily accept such a large displacement of reactive.

Generator Behavior Described

Changes in conditions are shown in Fig 4(a) for a generator which is tied into a very large system after a short-circuit develops on the field leads. Large inductance of the field winding causes the field current to decay gradually. As field current decreases, the magnetic tie between the stator and rotor is weakened, and the rotor angle advances to allow the generator to continue delivering normal power. Var output of the machine decreases and finally goes leading as the field current decays. Rotor angle continues to advance until further advance decreases output power and the generator slips the first pole. This point is shown at about 4.5 sec in Fig 4(a) in the illustration above.

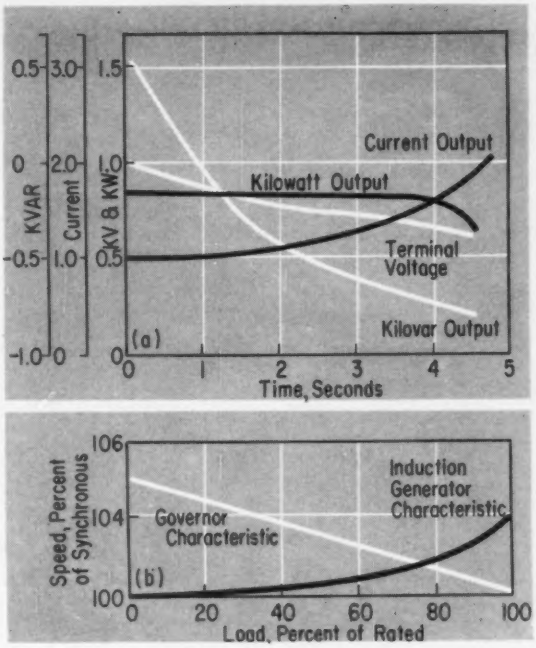


FIG 4—GENERATOR BEHAVIOR is plotted during a loss-of-field condition. Unit slips the first pole at about 4.5 sec in (a); final operating power of unit as an induction generator is determined by intersection of curves in (b)

The machine will continue to slip poles with some small value of field current remaining. Eventually field current will decay to a negligible value; the generator will stabilize and run slightly above synchronous speed as an induction generator. The machine will continue supplying power to the system, but must receive all its excitation requirements from the system. Power will drop off slightly as the unit runs above synchronous speed because of the regulation of the turbine governor. Final operating power level will be determined by the intersection of the governor characteristic with the speed-load characteristic of the induction generator, as shown in Fig 4(b).

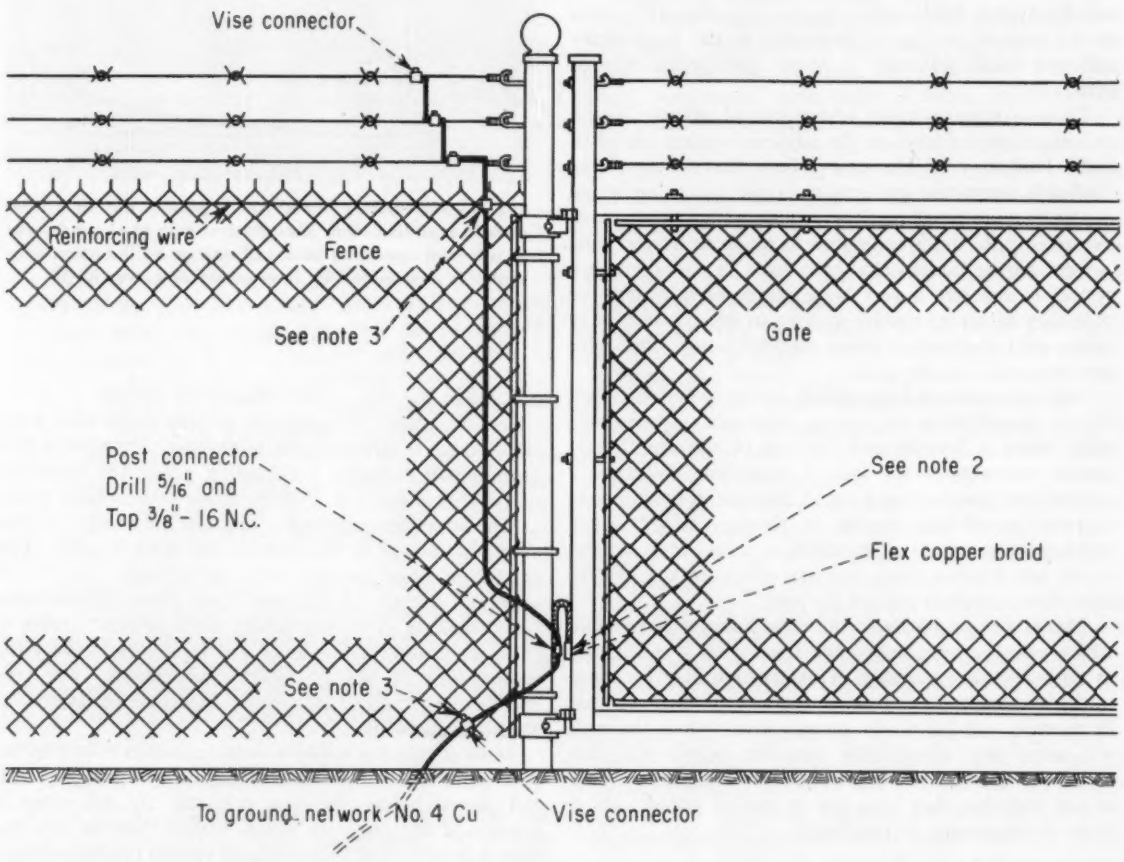
Most companies apply loss-of-excitation relays on the new large units to detect this condition during the initial period before the first pole-slip. If this relay is connected to sound an alarm rather than to trip the unit, it is advisable to investigate system conditions during a load-flow study to make sure that the system can accept the large displacement in reactive. Otherwise, system stability may be endangered.

Rotor May Be Damaged

In addition to endangering system stability, loss of excitation presents another problem. The generator rotor may be damaged if the unit remains connected to the system for too long a time without excitation. This is due to the large currents which flow in the wedges and retaining rings when the unit runs out of synchronism. If the condition persists for longer than 2 or 3 min, the unit should be tripped off the line.

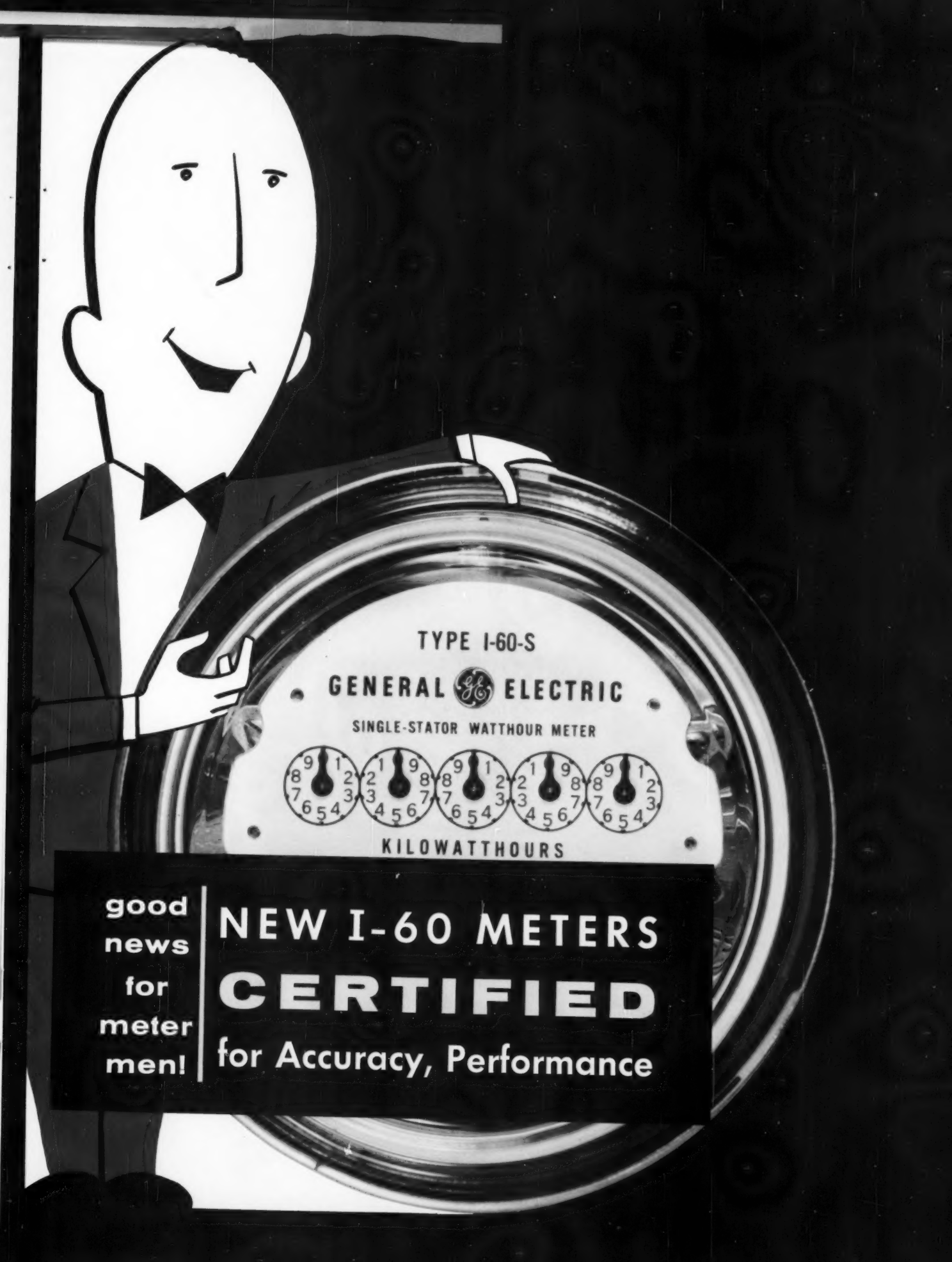
Grounding Chain-Link Fence and Gate

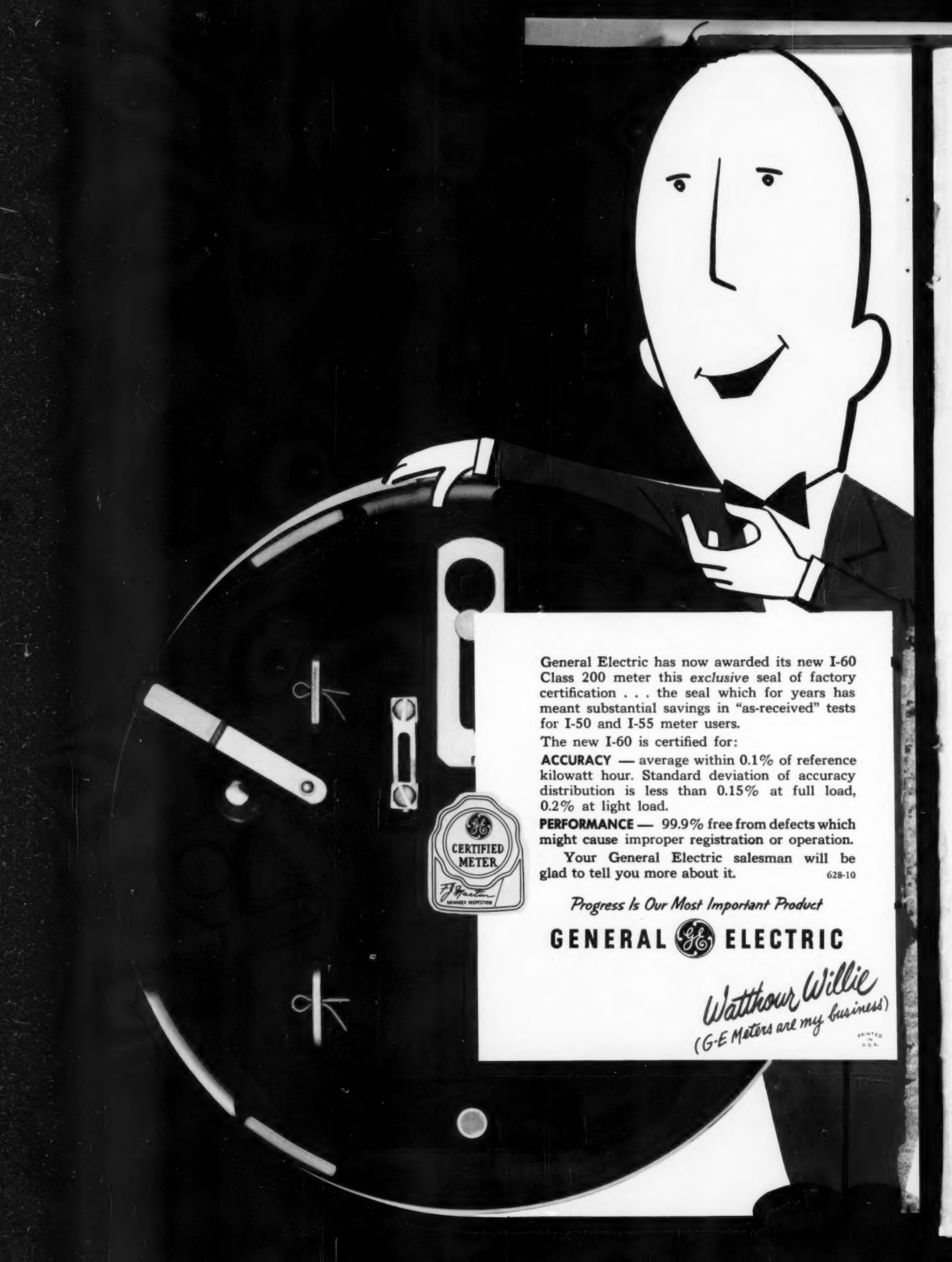
A method is outlined for grounding a substation fence and gate. It is adapted from construction standards of Virginia Electric & Power Co.



Notes:

1. Each corner, angle, and opening post is to be grounded in similar manner. Similar connections are to be made about 75 ft apart.
2. Flexible copper braid is to be mounted so that it will not be subjected to damaging strain when gate is fully open in either direction.
3. When horizontal rail is provided instead of reinforcing wire, the vertical copper ground wire is to be connected to it by means of a connector, ⅜ in.-16 thread. When there is neither a horizontal reinforcing wire nor a rail, the vertical ground wire is to be connected to the fence mesh near the top and bottom by vise connectors.
4. When H-column line posts are provided, the web is to be drilled and tapped to receive the connector.


TYPE I-60-S
GENERAL ELECTRIC
SINGLE-STATOR WATTHOUR METER
KILOWATTHOURS
good news for meter men!
NEW I-60 METERS
CERTIFIED
for Accuracy, Performance



General Electric has now awarded its new I-60 Class 200 meter this *exclusive* seal of factory certification . . . the seal which for years has meant substantial savings in "as-received" tests for I-50 and I-55 meter users.

The new I-60 is certified for:

ACCURACY — average within 0.1% of reference kilowatt hour. Standard deviation of accuracy distribution is less than 0.15% at full load, 0.2% at light load.

PERFORMANCE — 99.9% free from defects which might cause improper registration or operation.

Your General Electric salesman will be glad to tell you more about it. 628-10

Progress Is Our Most Important Product

GENERAL ELECTRIC

Watthour Willie
(G-E Meters are my business)

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B&W Ships Large Drum to Japan

A 330,000-lb boiler drum, reported to be the largest and heaviest exported to date from the United States, has been sent to the Chiba Thermal Power Station of the Tokyo Electric Power Co. The drum, manufactured by The Babcock & Wilcox Co, has an over-all length of 67 ft and is approximately 8 ft in diameter.

Included in the shipment of the drum was 57,000 lb of miscellaneous boiler equipment.

Purchased for the utility by International General Electric Co the boiler will serve a 175 Mw turbine generator. This unit was designed for a steam capacity of 1,300,000 lb per hour. It is designed for 2475 psi, 1060F, with hourly reheat of 1,100,000 lb steam at 475 psi, 1010F. Depending on Japanese fuel conditions, the unit will burn either 201,000 lb of pulverizing coal or 71,200 lb of oil per hour.

Microfilm Enlargement Made on Projection Paper

A photographic projection paper for production of high-contract enlargements from microfilm negatives has been developed by Eastman Kodak Co, Rochester, N. Y. The paper is obtainable from Kodak industrial and microfilming dealers beginning this month.

Designated Kodagraph Projection Paper, Translucent, the new paper is expected to expedite retrieval of engineering drawings which have been reproduced on microfilm. The projection paper may be used to make translucent, vellum-type reproductions of tracings for immediate use or for production of multiple prints on a direct process machine.

Cable Supporting Systems Cope's New Listing

The line of power and control supporting systems marketed by T. J. Cope Div of Rome Cable Corp is presented in a recently published 60-page, loose-leaf catalog. System components of the expanded metal type include, cable trough, cable ladder, cable channel, and Rak-it system supports and accessories, as produced at the Collegeville, Pa., plant.

In addition to the galvanized steel line, this catalog, No. 1257, features aluminum trough, ladder and channel up to 24-in. widths.

The items are described, well illustrated, and are accompanied by considerable data for layout and design of a trough or ladder system.

Blaw-Knox Towers Go to PE–110 of Them

Blaw-Knox Co's Tower and Antenna Dept, Pittsburgh, Pa., has designed and fabricated 110 towers 115 ft high for the Philadelphia Electric Co. These towers support three 795,000 cm ASCR conductors and two 134,600 cm ASCR ground wires on the Bradford-Chichester line.

Approximately 3.5 miles of the 220-kv line is in a valley subject to severe flooding. The towers in this area are supported by 30-in. dia reinforced concrete pedestals on concrete foundations. The 19-mile line was recently completed to carry power between substations.

A-C Receives Three Hydroturbine Awards

Allis-Chalmers Mfg Co has received three awards recently from utilities for the installation of hydraulic turbines. These include:

A hydroturbine rated 57,500-hp to operate under 170-ft head at 120-rpm (to deliver 68,000-hp at 190-ft head) for a new extension to the Pacific Power & Light Co's Merwin Plant on the Lewis River near Woodland, Wash.

The Francis runner weighs about 60,000 lb, measures 166 in. at its greatest diameter and is 6 ft from top of the crown to the bottom discharge band. The unit is expected to be in operation this summer.

Two awards have been made by the Alabama Power Co. One calls for two 39,100-hp, 49-ft head, 90-

(*Continued on next page*)

rpm units with fixed blade propellers for Weiss Dam on the Coosa River in Alabama. The units will be designed for concrete scroll case settings.

The other award was in January for a 111,500-hp, 210-ft head, 138.5-rpm Francis runner type hydraulic turbine for the Warrior River Project. (EW Mar. 10 p 98).

Kennecott Doubles Planned Capacity at Baltimore

Kennecott Copper Corp's new electrolytic copper refinery near Baltimore, Md., will have its planned capacity more than doubled. The initial capacity will be 16,500 tons per month compared to the original plan for 7,000 tons per month, according to Frank R. Milliken, vice president.

The larger plant will cost approximately $30 million, compared to about $20 million for the original plan.

M. W. Kellogg Co was recently awarded the contract for engineering and construction of the plant which is expected to be in operation in 1959.

NEPCO Process Provides Long Cable Life

National Electric Products Corp, Pittsburgh, Pa., has developed a process which reportedly provides a long life in Nepcozone butyl insulated cables.

The process is said to give the cables three important qualities: It assures concentricity of the conductor and insulation with a uniform wall thickness; vulcanizing agents are expelled as volatile decomposition byproducts; and void-free structure is assured.

Nepcozone butyl rubber was designed specifically for high-voltage applications where the inherent resistance of butyl rubber to ozone and corona is advantageous. It is used in power cables up through 15-kv, through the circular mil sizes, and is accepted for copper temperatures up to 90C (194F) in dry installations, or 85C (185F) in wet or dry installations.

R&IE Adds Rating, Remote Indication to MB2 Recloser

Another rating and attachment have been included in the new features added to the Type MB-2 recloser manufactured by R&IE Div. of I-T-E Circuit Breaker Co, Greensburg, Pa.

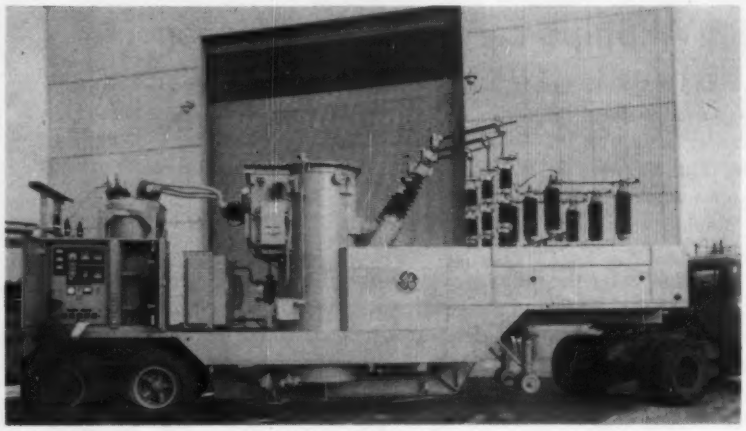
A new rating of 70 amp is included in the line of 15-kv automatic circuit recloser. This is in addition to the 100-, 140-, 200- and 280-amp ratings currently listed.

Remote indication of open-closed position is now available through the optional use of a new auxiliary switch attachment. In this switch, two-pole, single-throw contacts are arranged so that one contact is normally closed when the recloser is closed and second contact is normally open when recloser is closed.

The foregoing features, also provision for adjustable minimum pickup and addition of two-instantaneous trips (EW, Mar. 17, p. 83), are available when specified with the MB-2 automatic recloser.

Trucks Used in Publicity

Thomas Industries Inc, Louisville, Ky., has converted its shipping operations into a rolling outdoor ad campaign. The fleet of 40 trucks becomes rolling salesmen which travel in an area between Denver and the East Coast. These Chevrolet-powered tractor-trailers carry interchangeable 15-ft long, 4-ft wide, full-color advertising signs for the company's Moe Light and Wright Power Saw Divisions.



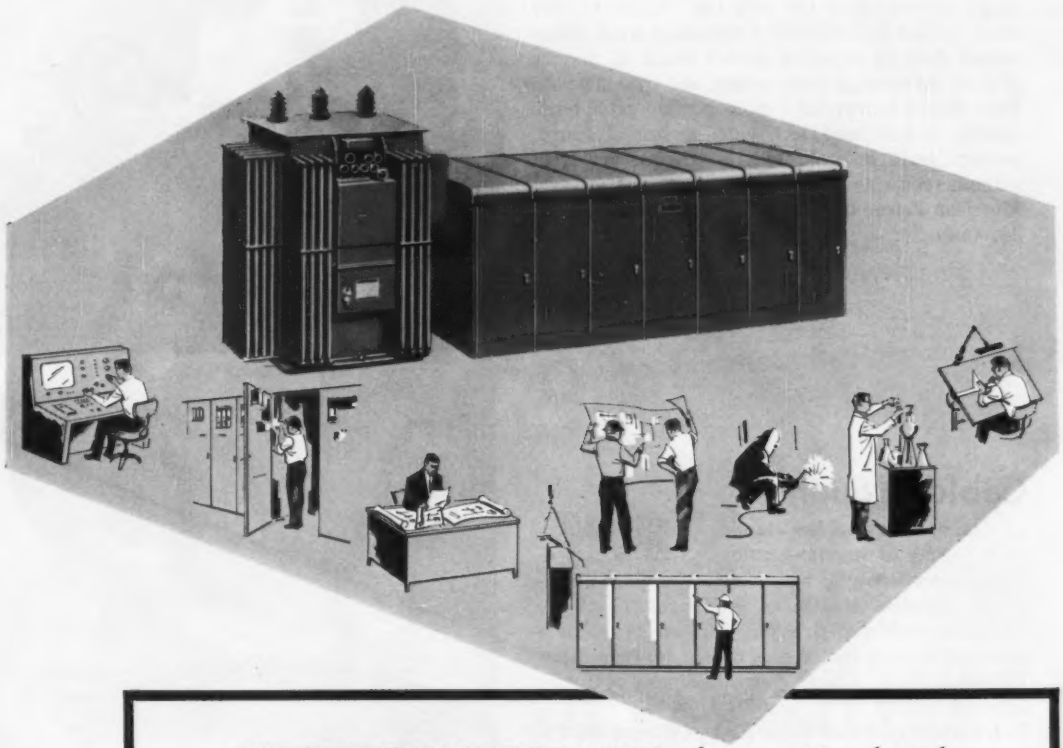
Mobile Substation Has Al Components

A 7500-kva trailer-mounted substation with an aluminum transformer tank and structural parts was shipped to Tampa Electric Co from General Electric's Transformer Dept at Pittsfield, Mass. This unit will be used to maintain electric service while regular station equipment is being inspected or repaired, or in emergencies when storm or flood may disable permanent substation equipment.

Aluminum components are incorporated in the substation construction to help meet weight limitations on secondary roads. The unit weighs 46,600 lb, is 31 ft 4 in. long, 8 ft wide, and 12 ft 5 in. high. In addition to the tank, other aluminum parts are heat exchanger, bins, frame for switches and side paneling.

This rolling substation has a 3-phase, FOA transformer for voltages 13,800×69,000 — 2520/4360Y×5040/8720Y×7560/13080Y. Other equipment includes high voltage fuses, disconnect switches, lightning arresters on high- and low-voltage sides, outdoor oil circuit breaker, internal terminal board for changing voltage, and control cabinet.

Packaged unit substations mean packaged skills



THE SUBSTATION-ORIENTED SKILLS of up to 35 technical experts are included in the purchase price when you buy substations as factory-built units. You get the skills of these people . . .

- Test engineers
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- Design engineers
- Installation engineers
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. . . . . and many others—without adding a man to your payroll. General Electric Company, Apparatus Sales Division, Schenectady 5, New York. 512-23

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New Equipment

Portable Hoist . . .

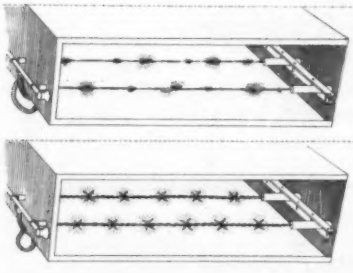
. . . permits installation of 3 transformers in 30 min. Weighing 42 lb, this two-piece unit can be easily assembled at the pole top. Standard pole chains secure base to pole. Cable from truck winch passes through standard snatch block at bottom of pole, up through hoist tubing, and over sheaves. Rear sheave is dropped 2 in. to prevent cable bind. Special swivel head has wide horizontal range, permits multiple mounting on pole or crossarm without removing hoist base.

Morrison Pelsue Co, 2256 S. Delaware St, Denver 23, Colo.

Cable Trough . . .

. . . made of expanded aluminum is available in wide variety of standard fittings. Solid sides provide greater strength; light weight simplifies installation. Straight lengths of 8, 10, or 12 ft are offered in widths of 6, 9, 12, 18, and 24 in. Sections are secured by flat pins driven between interlocking barrels. Aluminum resists many corrosive atmospheres.

T. J. Cope Div, Rome Cable Corp, Collegeville, Pa.



Precipitator . . .

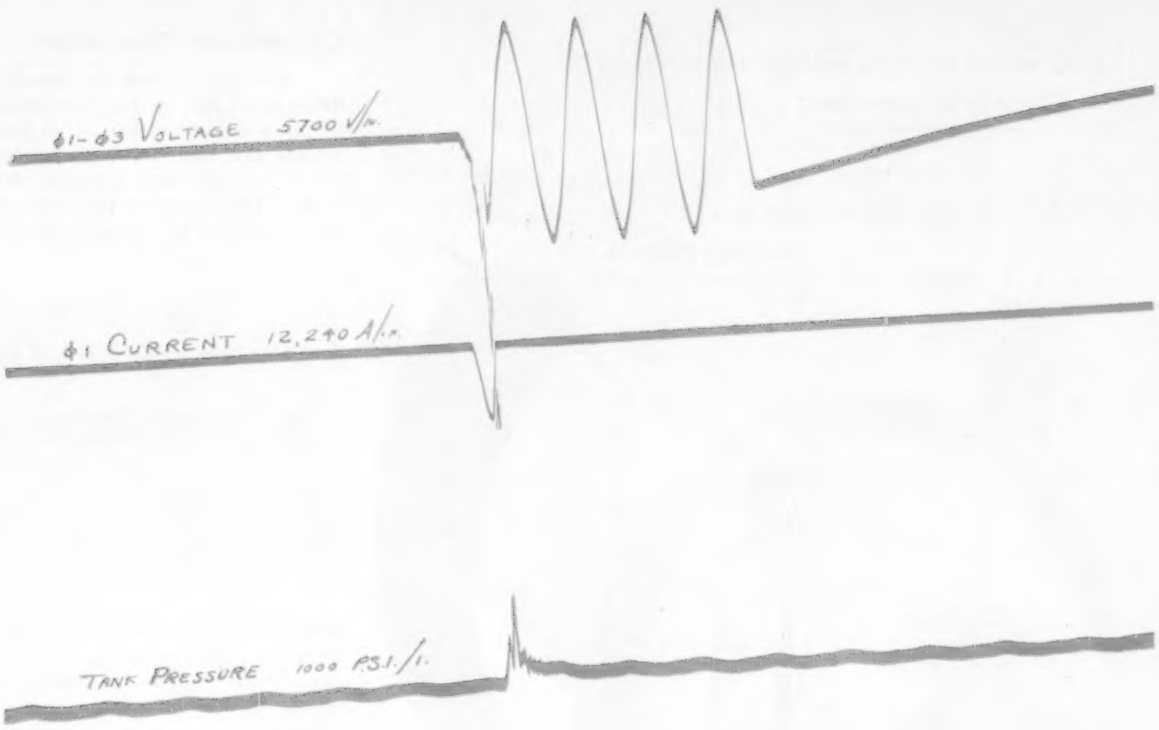
. . . has barbed energizing electrodes to improve control of corona discharge and permit use of higher electrode voltage for more efficient cleaning. Despite build-up of insulating deposits on electrode, barbs remain clean; discharge always occurs at barbs. Improved electrode permits increase in capacity of existing precipitators.

Metal Products Div, Koppers Co, Inc, Baltimore, Md.

Magnetic Contactor . . .

. . . rated 1,350 amp at 600 v is addition to existing line. Designated Type 425-8D, this size 8, a-c, clapper-type, 3-pole unit features BO arc interruption which eliminates the conventional blow-out coil and its connections. D-c operators eliminate hum and chatter, pick up at 65% rated voltage, and hold in at as low as 35%. It may be used for ovens and furnace heating circuits and to start motors up to 900 hp at 440 v or 450 hp at 220 v.

Allis-Chalmers Mfg Co, Milwaukee 1, Wis.



TESTS SHOW

EXTRA

INTERRUPTING CAPACITY

FOR THE G&W FC42 OIL FUSE CUTOUT

interrupting capactity 12,000 amps. asymmetrical - 2.5kv, 200 amps.

extra interrupting capacity 16,000 amps. asymmetrical - 2.5kv, when fused at 100 amperes or less

This cutout can be used where there is an available fault current of 16,000 amperes (asymmetrical) provided that a fuse link rated 100 amperes or less is used. The application rating of 16,000 amperes at 2,500 volts is made possible by the current-limiting action caused by the fuse melting before the current can reach peak value. The fuse melts in only a fraction of the first half of the cycle of fault current and limits the current to a relatively small value.

Investigate the possibilities of using the FC42 in place of more expensive protective equipment. Consider, also, its use for sectionalizing circuits under load. A linkage readily adapts multiples of the cutout to gang operation for use as multi-pole oil switches. A G & W representative will be glad to help you.

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CANADIAN MFR.- POWERLITE DEVICES, LTD. • TORONTO, MONTREAL & VANCOUVER
C581

I wish we had more personnel and time to prepare this study for a new power plant and site.

Your regular staff is overloaded now. Call in the specialists and let them carry the peak load. How about Pioneer?

Give your non-routine operations to Pioneer

Design and Consulting Engineering Services. Pioneer has specialized in designing power plants for 56 years. It offers design service for fossil fuel, hydro and atomic plants. It will also assist in forecasting load growth, in site selection, in purchasing and expediting of equipment and in supervising construction. Pioneer's other services include substation, transmission and distribution studies and design.

Services in Regulatory Matters. Pioneer offers its services in all phases of Federal, State and Local regulation including the rate base, depreciation analysis, cost of service studies, market analysis, certificate proceedings and rate of return.

Corporate Services. Pioneer's services in corporate matters include business and management engineering advice, financial, accounting and tax counsel and insurance and pension plans and programming. It maintains a complete stock transfer, ledger and dividend disbursement service.

NEW!
On your letterhead, write for 40-page booklet, "Pioneering New Horizons in Power". Describes Pioneer's engineering services, and corporate services, from financing to operation.

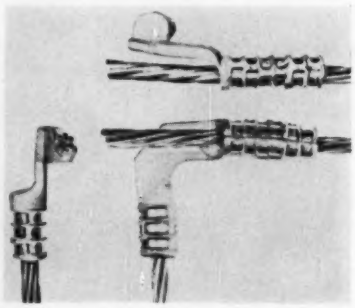
56 YEARS

Pioneer Service & Engineering Co.

231 SOUTH LA SALLE STREET, CHICAGO 4, ILLINOIS

Compression Connector . . .

. . . has run and tap on opposite sides of the L-bar so that drip from a copper run can not fall on an aluminum tap and cause corrosion. Useful for taps from hot runs, the Penn-L-Tap is quickly hooked over the run and can be crimped with any



standard crimping tool. Both ends are color-coded to show conductor size. Made of pure aluminum, it may be used on all combinations of aluminum-to-copper or aluminum-to-aluminum.

Penn-Union Electric Corp, Erie, Pa.

Hydraulic Derrick . . .

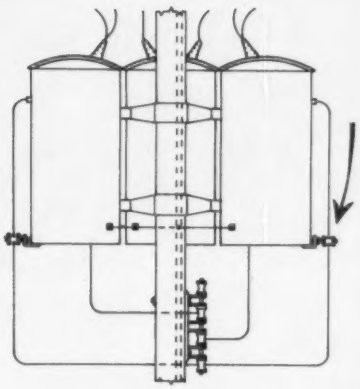
. . . can be used for lifting or, with digger attachment, for digging holes at any point within 180-deg, 26-ft radius of truck. Known as the Hydra-Lift Model 60HB, it can be used to set poles without removing auger attachment. Digger is powered by same hydraulic system as Hydra-Lift and handles augers with diameters up to 24 in.

Pitman Mfg Co, 300 W 79th Terrace, Kansas City, Mo.

Textile Motor . . .

. . . with 4-pole, 5-hp rating is addition to Tenv line. Enclosed, nonventilated design minimizes fire hazards by preventing lint from coming in contact with the windings. It is designed for applications such as spinning and roving frames, or

warping and twisting machines. Construction facilitates special designs such as brake motors.
General Electric Co, Schenectady 5, N. Y.



Secondary Lead Bracket . . .

. . . for transformers clamps over rolled bottom edge of steel-tank units to support lead wires. Fitting all popular steel tank distribution transformers, it is furnished with brown-glazed porcelain insulator assembled. Clamp and bolt are hot galvanized steel.
A. B. Chance Co, Centralia, Mo.

Frequency Changer . . .

. . . provides 50 or 60-cps output from any input frequency. A-c input is rectified, then fed to special dc-to-ac converter. Rheostat provides ± 10% adjustment for cycle variation. Known as the Change-A-Cycle, it is available with output capacities from 40 to 2,000 w, for 1 phase or 3-phase input.
Carter Motor Co, 2737A W. George St, Chicago 18, Ill.

Asbestos Tape . . .

. . . may be used as fire protection where cables cross or run side by side, particularly in underground manholes. Tape has $\frac{3}{16}$-in. diam. and is available in 1-in. and 2-in. widths, in 25 ft rolls. It has extra 0.5 in. of listing tape which overlaps each spiral for a tight, permanent fit. Insulwrap can also be used on pipes carrying steam and hot and cold water.
General Asbestos Gasket Mfg Corp, 1029 Lafayette Ave, St. Louis 4.

INTERCHANGEABLE DOORS provide a quick easy means of converting Type E Cutouts to a higher interrupting rating or to a disconnect. Each housing will accommodate three different door assemblies.

NEW CHANCE 10,000 AMP CUTOUT

new ease of operation... interchangeable ratings... resiliency to resist shock

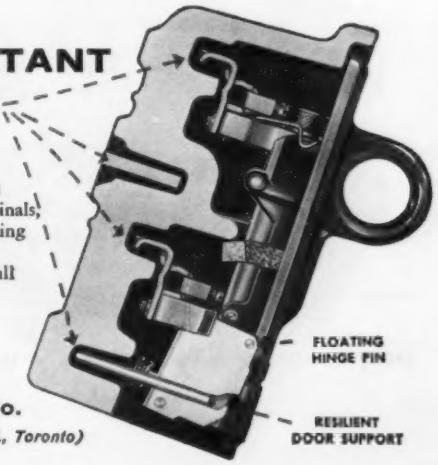
These new porcelain enclosed cutouts cover the complete range of NEMA ratings in 50 and 100 amp cutouts, and 100 and 200 amp disconnects. Rated 5.2 and 7.8 KV, they have interrupting capacities from 2,000 to 10,000 amps.

Special socket inside the door permits doors to be completely installed and removed from any angle or position with a standard hook stick—an *important feature to operating men.*

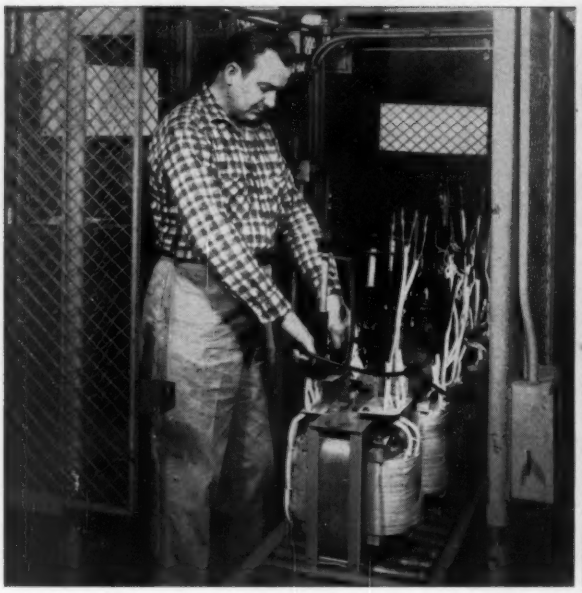
The "E" Cutout can be used as a flag indicating cutout with the built-in drop-down flag that signals an outage, or as a full 180° dropout cutout that permits easy removal of door with a hook stick.

SHOCK RESISTANT EPOXY RESIN MOUNTING

The use of epoxy resin mountings gives strength and resiliency to contacts, terminals, trunnion, and mounting hanger. A floating hinge pin and mounting of the door assembly on a resilient trunnion gives full protection against door breakage. Ribbed housing provides high dielectric strength.



A. B. CHANCE CO.
General Offices: Centralia, Mo.
(A. B. Chance Company of Canada, Ltd., Toronto)
CK58-7



RATIO TEST double checks exact number of turns on each coil against automatic count of winding machines.

CORE LOSS AND COPPER LOSS TESTS determine the excitation loss, impedance and load losses at rated current.

WAGNER FORM W TRANSFORMERS
PERFORMANCE-PROVED BY TESTS

The extreme care used in building Wagner Form W Distribution Transformers starts with advanced engineering design and rigid quality control of all materials used in the transformers. It is carried on by highly skilled workers through every step of assembly. And, it is *proved* by exacting inspections and tests to assure that every Wagner Form W Transformer has the ability to provide many years of trouble-free service.

Electrical tests at various stations along the production line include all commercial tests prescribed by ASA and NEMA. Mechanical inspection includes tests for possible leaks in welded seams or around bushings.

All Form W Transformers, in ratings 3 through 167 kva, 15 KV and below, are designed for pole mounting. Form W Transformers are available for every requirement of modern distribution systems—500 kva and smaller, 69 KV and below.

You can choose either conventional or protected type Form W Transformers for your distribution lines with full confidence that they will pay dividends in longer service life.

Bulletin TU-141 gives complete information on Wagner Form W Distribution Transformers. Write for your file copy today.

Wagner Electric Corporation
SERVING INDUSTRY SINCE 1891

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

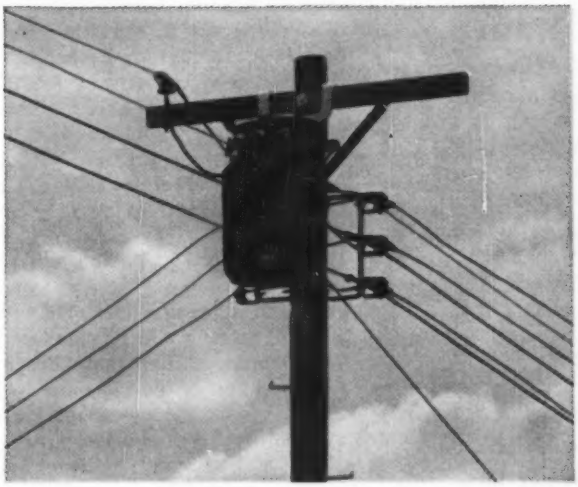
Wagner Electric Corporation
6456 Plymouth Ave., St. Louis 14, Mo., U.S.A.

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC

GROUND AND DOUBLE NORMAL TEST. Complete transformers are given dielectric tests for applied potential and induced potential.

IMPULSE TESTS prove the ability of every Wagner Form W Transformer to operate under greater stresses than it will meet in normal service.

TO PROVIDE LONGER SERVICE LIFE!



Today's Wagner Form W Transformer is exactly right for modern distribution systems. Its small size and light weight make it easy to handle—to store—to mount on poles.

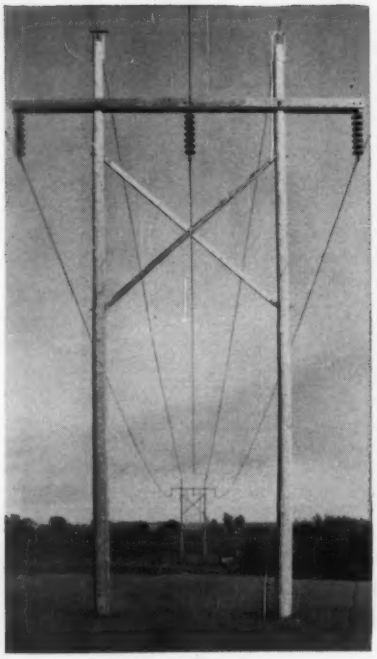
LIVE BETTER ELECTRICALLY

WT58-10

Now...PAGE & HILL maintains 3

MECHANIZED YARDS

and treating plants



. . . with modern handling equipment to supply you promptly and efficiently with *completely* decay-immune power-line poles —

LIFE-SPAN WESTERN RED CEDAR POLES

or Treatments to comply with all approved E.E.I. or A.W.P.A. non-pressure specifications.

PAGE & HILL, Inc.
Minneapolis 3, Minnesota

Construction Boom

(*Continued from page* 74)

is a $4.9 million expenditure to complete a 44,000-kw generating plant on the Yellowstone River near Sidney.

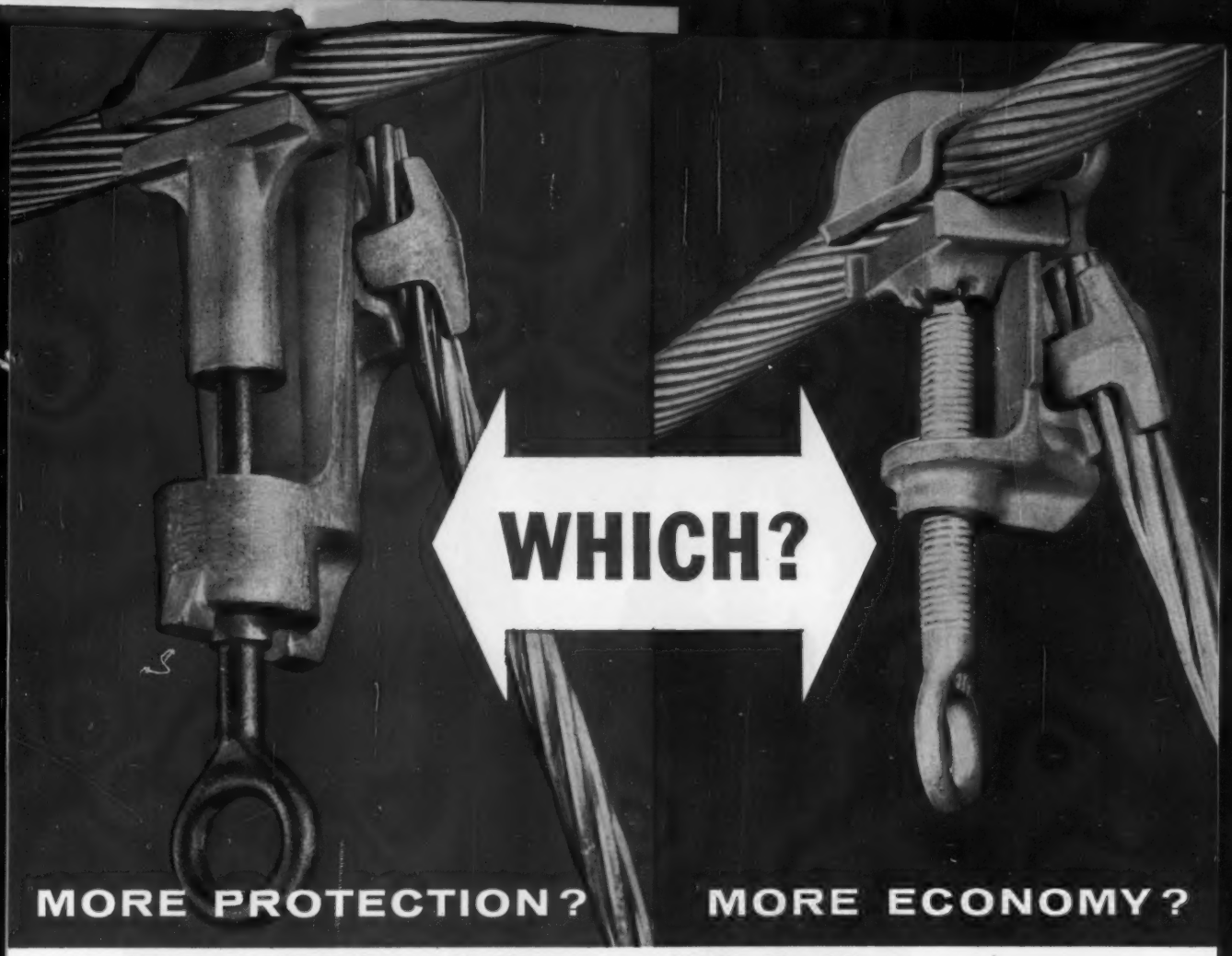
Ohio Power Co plans to spend $62 million for expansion in 1958. Most of the money will go for construction and expansion of power generating plant including ones at Beverly, Ohio and Captina and Graham Station.

Pennsylvania Electric Co has earmarked $41.5 million for new facilities in 1958. Much of this will go to carry forward work started in 1957 and for two 185,000 kw generating units for Shawville Station near Clearfield.

Portland General Electric Co will spend most of its projected $27.4 million construction budget in 1958 to expand hydro facilities. Some $13.4 million will go for three major hydro projects at Pelton, North Fork and Faraday.

Rochester Gas & Electric Corp has allocated $22 million for 1958 expansion. Largest single construction project will be work on a new unit at Alexander M. Beebee Station, having a capacity of 83,500 kw and expected to be completed in 1959.

Southern California Edison Co has budgeted $130 million for construction and plant expansion in 1958. Of this $40 million will go to add 865 miles of new distribution and transmission lines. The first 200,000 kw unit will be completed this summer at Huntington Beach. A second unit of the same size will go into service the end of the year. Two more units of equal size under construction at Mandalay Beach are to be completed in the spring and fall of 1959 respectively. Work started recently on the $50 million "Mammoth Pool" project in the High Sierras requiring construction of an earth-filled dam 950 ft long and 330 ft high. Edison will spend $19 million in 1958 to build seven new substations, one of which is to be built near Saticoy at a cost of $2.5 million.



(HLP Enclosed Thread Spring Compensated Clamp: 4 clamps — #6 solid to 636 MCM ACSR)

(HL Open Thread Clamp: 5 clamps — #8 to 1431 MCM ACSR)

Now...Two New Hot Line Clamps

Take your choice of Anderson's two new series of hot line clamps: the extra protected HLP, or the economical HL. Both come in cast aluminum or plated aluminum, and both have basically the same rugged, long-life features: (1) Large area, high pressure main and tap contacts on the same casting for full current flow, low resistance. (2) Massive plated bronze eyebolt terminals, designed to pass the Mercurous Nitrate Test, insure protection from season cracking and stress corrosion. (3) Extended "duck-bill" upper contact and deep cable seat make quicker installation, prevent cable "walk-off" during installation!

HLP "extras" are a heavy duty, Vanadium Steel-plated multi-coil spring and a threaded, permanently inhibited chamber to assure an arc-proof and corrosion-proof eyebolt stem. Completely housed in the main casting but away from the current path, the spring compensates for cable cold flow, temperature changes, relaxation, heavy fault currents. Much higher contact pressure with the same eye-stem torque results from the new in-line pressure mechanism. So, take your pick. Both the HL and HLP do the job, are simple to install, and ruggedly built for extra long life.

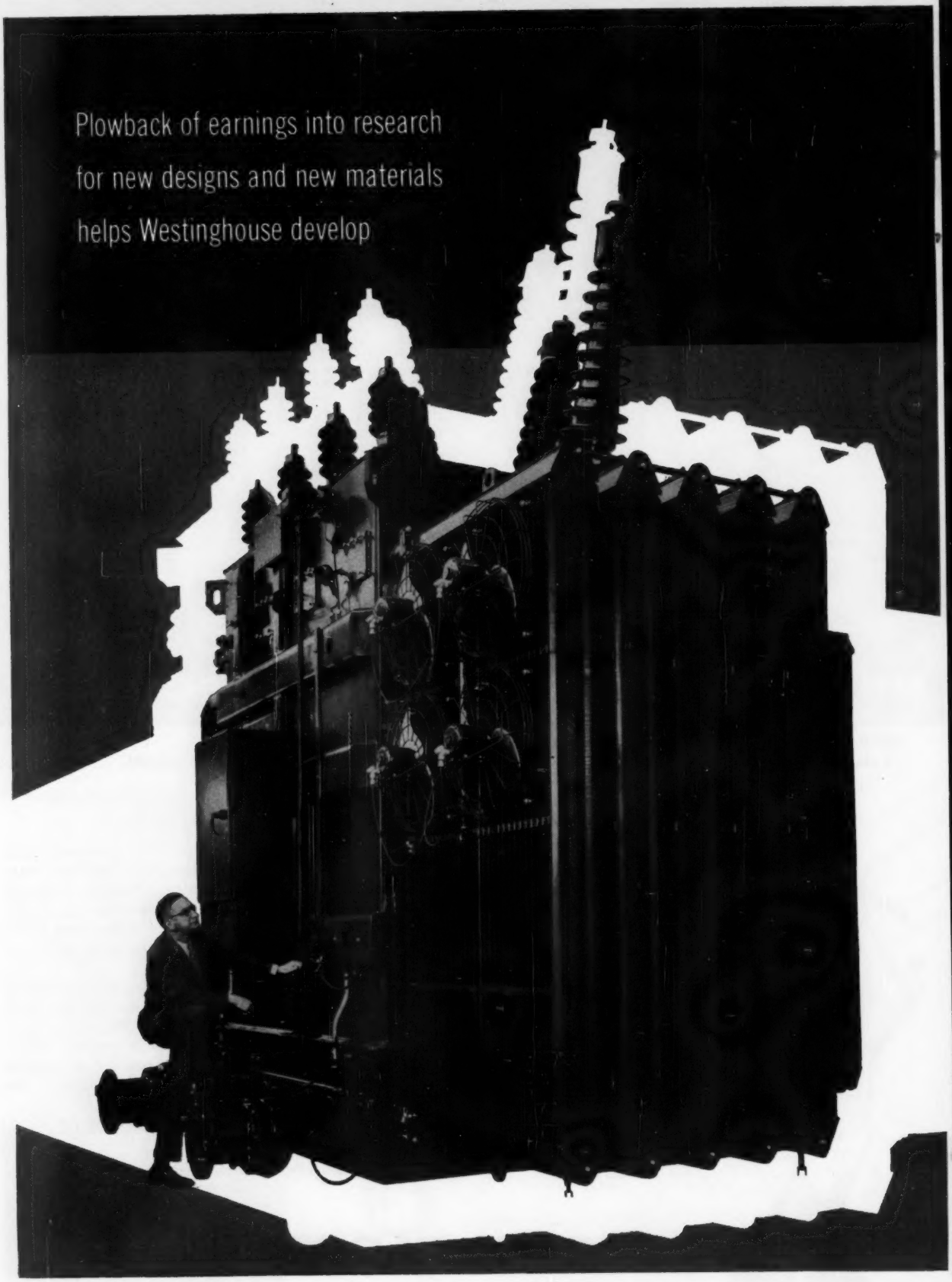
ANDERSON ELECTRIC CORPORATION
Birmingham 1, Alabama

Export Representative: International Standard Electric Corp.
50 Church Street
New York 7, New York

ANDERSON ELECTRIC

Research / Quality / Performance / in Aluminum and Bronze Products

Aluminum and Bronze Power Connectors • Clamps • Fittings • Accessories for SUBSTATION • TRANSMISSION • DISTRIBUTION


Plowback of earnings into research
for new designs and new materials
helps Westinghouse develop

THE THIRD MAJOR BREAKTHROUGH... NEW INNER-COOLED CONSTRUCTION CRASHES SIZE BARRIER, PAVES WAY FOR SUPERVOLTAGE TRANSFORMERS

Pioneering again, Westinghouse has produced the third major breakthrough in power transformer development.

The first major breakthrough, forced-oil cooling, was developed by Westinghouse in 1940. It made practical for the first time construction of transformers up to 380,000 kva. The second breakthrough, the Schnabel car, also by Westinghouse, raised the practical kva to 450,000.

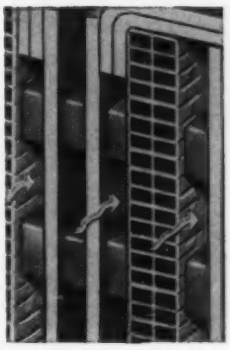
The *third* major breakthrough — Inner Cooling — makes it possible to build and ship transformers with ratings up to 600,000 kva or more. This is the biggest step to date toward construction of transformers that will meet the demands of the future.

Inner Cooling is essentially a means of taking full advantage of the materials used in conventional transformer construction. Present construction places the oil ducts on both sides of the coil consisting of multiple conductors wound in parallel. Inner-Cooled construction places the oil duct between the parallel-wound conductors, with cellulose material between adjacent coils. This construction takes full advantage of the superior dielectric strength of the cellulose material.

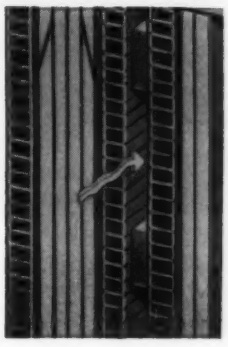
Inner Cooling promises transformers with lower impedances and improved performance, permits more kva in the same area. Space and weight reductions up to 25% for transformers of the same rating are now possible.

Inner Cooling — the third major breakthrough — was made possible through Plowback of Earnings into the far-flung Westinghouse facilities for research and development . . . facilities that are available to all Westinghouse divisions in their search for answers to future problems which are to be faced by America's electric utilities.

Call your Westinghouse representative for the full story on the new Inner-Cooled construction . . . or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania. J-70872



In conventional construction (above), oil flows over the two outside surfaces of the coil. With new Inner-Cooled construction (below), cooling oil flows over the inside of the coil surfaces.



Here is graphic proof of the size reduction afforded by Inner-Cooled construction: the unit shown with Mr. C. W. Miller, Westinghouse Power Transformer Engineering Manager, is an Inner-Cooled Westinghouse 30/50 mva OA/FOA power transformer; the silhouette is that of a transformer with the same characteristics built with conventional construction.

YOU CAN BE SURE... IF IT'S Westinghouse

West Penn Comes Up With a WHALE of a Deal

Electrical living gets a boost through employee cash purchase plan for wiring, appliances, and other electrical needs

West Penn Power Co has come up with a WHALE of a deal for its employees.

Tagged "WHALE", for **W**iring, **H**eating, **A**ppliances and **L**ighting for **E**mployees, it provides funds for company people for their direct cash purchases. The loans are then paid back over a two-year period through payroll deductions. Carrying charges are extremely modest.

By the end of February West Penn employees had received 836 loans totaling $294,327 to buy some 1,250 appliances and wiring jobs. The plan was started as an experiment in June, 1955. It continued through that autumn and part of 1956. It was put in regular operation at the beginning of 1957. Here's the way it works:

The West Penn employees selects the electric appliances he wants and purchases them from a dealer of his choice. Or, in the case of a wiring or electric heating job, he makes arrangements with a contractor.

Purchase Is Made in Cash

The purchase is made in cash. The employee pays as little or as much as he wants to from his own pocket. Then the remainder is obtained from West Penn on loan. Top limit on loans: 15% of the employees annual wage.

To get the loan, the employee first makes application through his supervisor. After approval by the department head, he gets his check. Repayment is made through payroll deductions. Loans are made for six, 12 and 18 months, with a minimum monthly amount of $5.00. Carrying charges amount to about half of 1% of unpaid balance, but can be computed to make monthly payments even. Example: On a $300 loan written for 12 months, the carrying charge would be $10.44 and monthly deduction would be $25.87; on a 24-month note, carry charge is $20.40, and monthly payroll deduction would be $13.35.

Employees' reaction has been enthusiastic. It has enabled them to capitalize on their enthusiasm for electric appliances during promotions and sales even though they might be short of cash.

What have they been buying? Most popular item is home laundry equipment. Together with a few ironers, automatic washers and dryers have accounted for more than a third of the purchases. Other items bought in quantity include water heaters, ranges, refrigerators, freezers, TV sets, dishwashers, air conditioners, heat pumps, space heating equipment and wiring.

Railroad Rx: Better Lighting = Safer Crossing

Houston Lighting & Power Co has installed a lighting system designed to reduce the inherent hazard posed by railroad grade crossings. Shown in the photo above are two fluorescent luminaires which are mounted diagonally at the traffic artery-railroad intersection. The approach side of the luminaires' globes are painted with yellow acrylic paint to indicate a danger area.

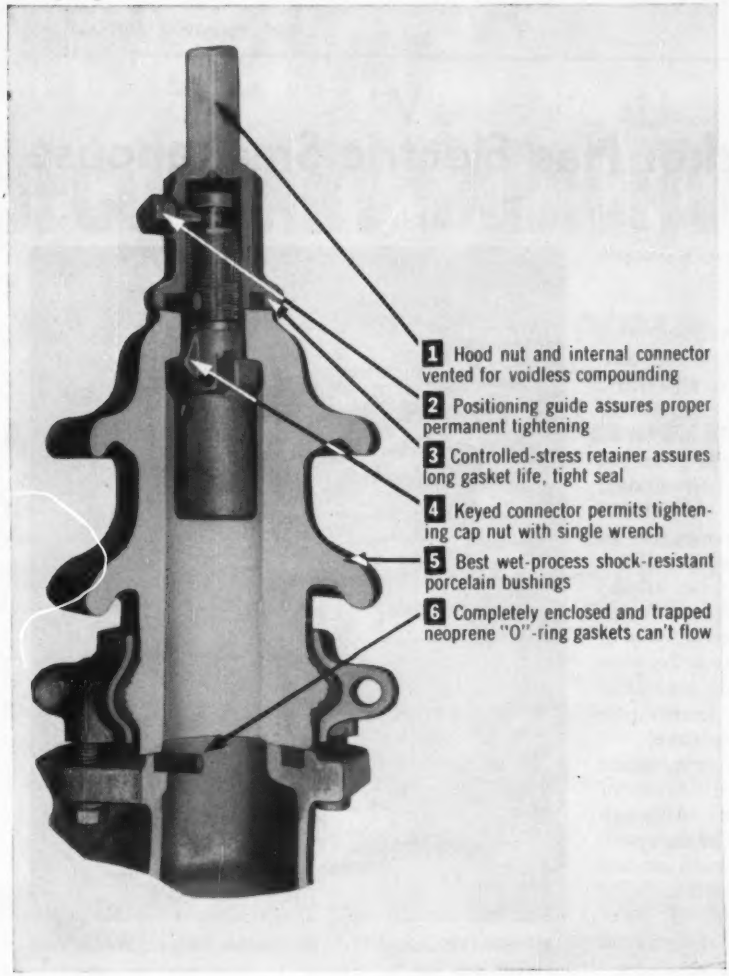
J. B. White, Houston's director of public service, proposed the lighting system. Encouraged by its success, the Houston City Council has authorized the installation of experimental lighting systems at 14 other dangerous grade crossings.

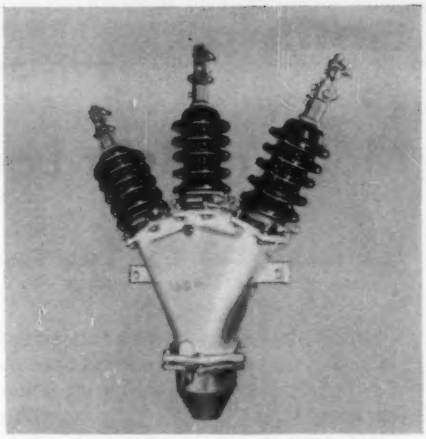
But the emphasis is not only in Houston. General Electric, which manufactured the luminaires mentioned above, held a Highway Lighting Institute at their Outdoor Lighting Dept offices in Henderson, N. C. Its purpose: To familiarize members of state highway departments and the Bureau of Public Roads with highway lighting systems and the modern design and engineering which goes into them.

Federal, State and Territory Reps Attend

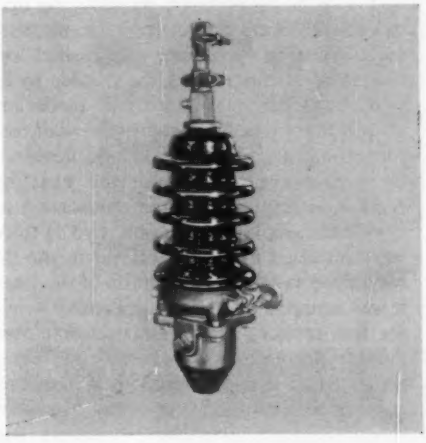
Two, three-day sessions covered systems and concepts that can be used to help provide maximum nighttime safety on the federal highways. A total of 79 representatives of the U. S. Bureau of Public Roads, 30 states, the District of Columbia and Puerto Rico attended. They received an indoctrination in basic highway lighting system design and application, and participated in workshop sessions devoted to the design of typical lighting systems for intersections, cloverleafs, tunnels and underpasses, etc.

(*More Selling on page* 102)


1 Hood nut and internal connector vented for voidless compounding
2 Positioning guide assures proper permanent tightening
3 Controlled-stress retainer assures long gasket life, tight seal
4 Keyed connector permits tightening cap nut with single wrench
5 Best wet-process shock-resistant porcelain bushings
6 Completely enclosed and trapped neoprene "O"-ring gaskets can't flow



Wide range of sizes and entrance fittings, with corrugated or petticoat-type bushings, meets most outdoor and indoor cable-sealing applications. Available in multiple conductor (above) or single conductor (below).



Delta-Star Permanently-Sealed Terminators keep air and moisture out for good

Delta-Star SEAL-KAP Terminators reduce servicing problems. The special neoprene "O"-ring sealing design of this line of cable terminators results in a *permanently* air-tight and moisture-proof installation. Original cost, in addition to installation and maintenance costs, is low.

SEAL-KAP terminators are made in single- and multiple-conductor styles for both outdoor and indoor service. Lightweight cast-aluminum bodies help make SEAL-KAP terminators easy to handle, contribute to their economy of installation.

GET COMPLETE INFORMATION in this new SEAL-KAP Terminator catalog. Write DELTA-STAR ELECTRIC DIVISION, H. K. PORTER COMPANY, INC., 2437 Fulton St., Chicago 12, Illinois. District offices in principal cities.

H. K. PORTER COMPANY, INC.

DELTA-STAR ELECTRIC DIVISION

Connors Steel, Delta-Star Electric, Disston, Forge and Fittings, Leschen Wire Rope, Quaker Rubber, Refractories, Riverside-Alloy Metal, Vulcan Crucible Steel, H. K. Porter Company (Canada) Ltd.

Modern Meat Locker Has Electric Smokehouse

W. A. NEWMAN, Industrial Power Sales Engineer, Washington Water Power Co, Spokane, Wash.

Lots of smoke, but no fire—not since Neighborhood Lockers, a wild game processer in Spokane, Wash., converted its meat smoking and curing house to all-electric operation. Operated in conjunction with a small freezer locker plant, the installation was originally put in to handle deer, ducks, elk, bear, and other wild game but has proven so successful that any of the conventional smoked meats can be prepared in it.

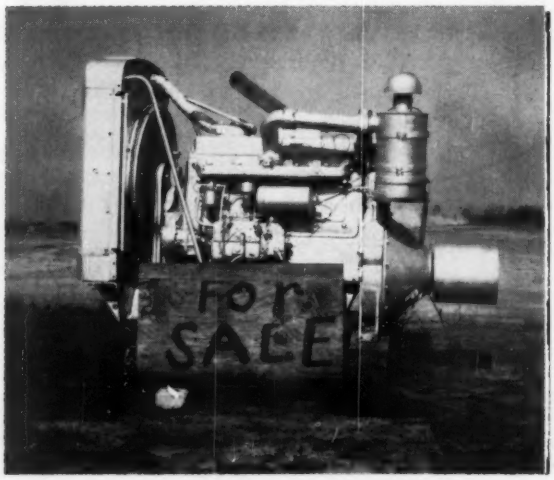
The building used for the smoking operation was an existing concrete block structure, measuring 4x6x7.5-ft high. Because the owner was rushed for time, he was unable to frame around the outside to cut heat losses.

To heat the room itself, for tenderizing, 7.5 kw of strip heaters were fastened to the wall, midway between the ceiling and the floor. These heaters are controlled by a thermostat to assure the exacting temperature regulation required for the tenderizing procedure.

For the smoking operation, two 500-kw strip heaters were installed in an existing pit in the floor. A pan of hardwood sawdust is set on top of the heaters. Although it was assumed that a voltage control would be necessary for this service, trials indicated that operation on line voltage produced a satisfactory heat, enough to make the sawdust smoke without bursting into flame. After correct temperature and time had been determined, results with the installation exceeded expectations.

STRIP HEATERS AROUND WALL provide heat for tenderizing. Pit units are just hot enough to make sawdust smoke

Motor Cuts Peeling Costs, Puts Diesel Out To Pasture



FRED G. SARTIN, Industrial Power Engineer, Alabama Power Co, Birmingham, Ala.

Maintenance costs dropped and production went up after the Baldwin Pole & Piling Co substituted electric drive for diesel power on a pole peeling machine. Although the cost of electricity and diesel fuel were about the same, the electric drive has boosted production 11.11%, based on actual running time. And it has eliminated the two to three days down time for maintenance, which, excluding production loss, cost almost as much as the monthly power consumption. The 100-hp diesel was replaced by a 100-hp motor after Walter Christian, Alabama Power's Mobile representative had presented all the facts to the owner. Pleased with the increase in production, the owner anticipates using more power in a new pole-treating operation now under construction.

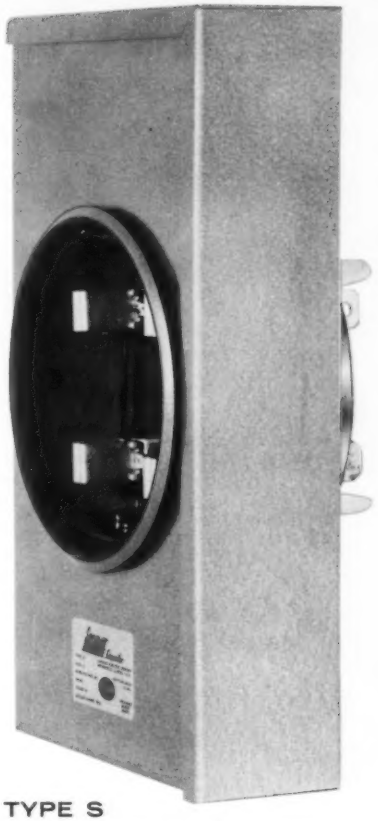
NEW... 2 kvar SECONDARY CAPACITOR

provides low cost vars at point of *greatest system benefit*

Here's the answer to utilities looking for a more economical 240 volt secondary power capacitor. The Sangamo Secovar Capacitor installs right at the meter box to relieve the var load all down the line, to cut installation costs, and to conserve valuable pole space.

Installation is simple. No wiring changes are necessary. No special equipment is needed . . . one man can make the installation in a matter of minutes.

Type S, shown here, is plugged into the meter socket. Bulletin 1131 gives full information.



TYPE S
2 kvar Secovar Capacitor

1 Plug Secovar unit into meter socket and install sealing ring.

2 Install watthour meter in Secovar socket.

3 Installation is complete—ready to supply vars to your system.

the Sangamo Secovar Capacitor*

*TRADEMARK

Sangamo Secovar* Capacitor

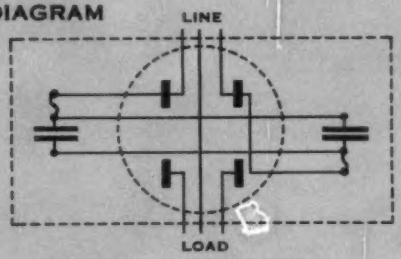
an important development in the application of SECONDARY POWER CAPACITORS

TYPE S

for socket mounting

This pre-assembled unit combines a secondary power capacitor with a convenient socket mounting adapter. The metal enclosure is mounted on a standard meter base—either vertically or horizontally. It contains two capacitor sections, each with a fuse in the lead for protection against line or ground faults. Available in 2 kvar, 240 volt rating.

WIRING DIAGRAM

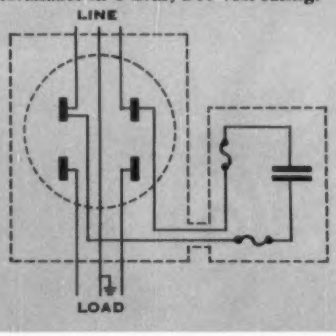


TYPE N

for adjacent mounting

This Secovar capacitor comes in a metal enclosure equipped with an adjustable mounting bracket and a nipple connection for installation with standard indoor or outdoor service entrance equipment. Two fuses inside the unit provide protection against either line or ground faults. Leads are provided to connect capacitor to the line side meter terminals. Available in 1 kvar, 240 volt rating.

WIRING DIAGRAM



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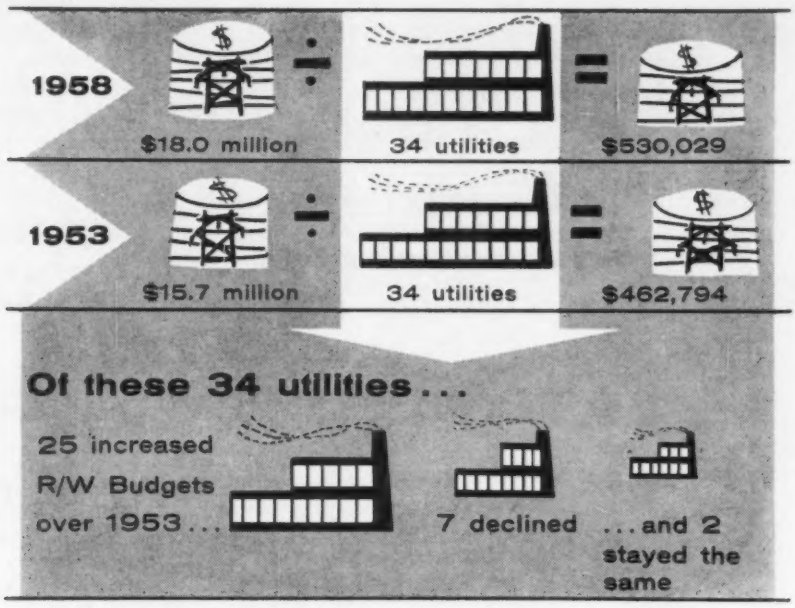
SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

*TRADEMARK

Report on
Right-of-Way



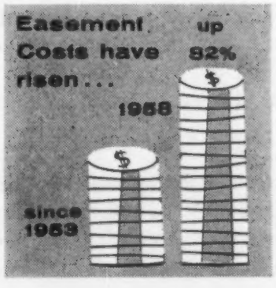
As right-of-way budgets climb . . .

Utilities Battle Rising R/W Costs

Electric utilities are coming to grips with their right-of-way problems. EW's Right-of-Way Meeting (see p 71) held in Chicago early this month drew 129 utility men together to thrash some of them out. Our second right-of-way survey, in which 76 utilities serving almost 26 million customers returned questionnaires, shows progress has been made—and points to some trouble spots ahead. Here are some highlights from the survey:

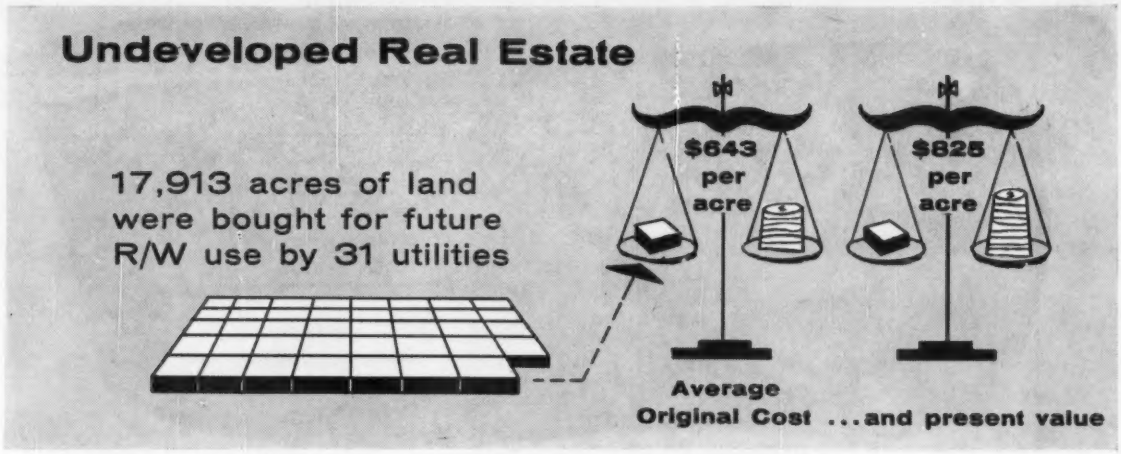
Utilities are spending more on rights-of-way. The average R/W budget for 1958 is 14½% higher than the 1953 average for the 34 utilities that reported both figures. Twenty-five of these utilities plan to spend more for R/W in '58 than they did five years ago, while only seven have reduced R/W budgets.

But within the general trend to higher budgets, there are marked variations. Individual R/W budgets for this year range all the way from zero to $3.5 million, depending, of course, on company needs. While one utility has cut its R/W budget down from $3.15 million in 1953 to $135,000 for '58, another big company has expanded from $1 million to $3.5 million. One company allocated 66% of its transmission budget to R/W costs, but the average was about 14%.



Costs of easements have soared in the last five years. One company cites a 500% price rise since 1953. Another reports 400%. On the average, the 67 utilities that reported changes in costs pay 82% more today for an easement than they did five years ago.

In an effort to beat these rising costs, many utilities have purchased undeveloped real estate, which they hold for future use. Thirty-one utilities reported that they


Undeveloped Real Estate
17,913 acres of land were bought for future R/W use by 31 utilities
$643 per acre
$825 per acre
Average Original Cost ...and present value

held a total of almost 18,000 acres for this purpose. Original cost of the land averaged $643 an acre. Present value is $825 an acre—a 28% increase.

Ten utilities buy all their transmission right-of-way in fee simple, and another five systems buy substantial portions. All told, 40 utilities said they acquired land in fee—with the percentages running from 0.33 to 100%.

Utilities reported wide differences in their price offers for easements. One company serving small suburban cities and rich farm areas in the Rocky Mountains offers $1,500 an acre for cultivated farmland and $4,000 an acre for land in potential subdivisions. Yet another—a cooperative—offers only $200 an acre for property in established subdivisions.

The average offer is 71% of appraised value for farmland (cultivated or not cultivated), 82% of appraised value in potential subdivisions, and 104% in established subdivisions. But one utility offers a flat 250% of appraised value across the board and, at the other extreme, another offers 4% for uncultivated farmland. Interestingly, the company that offers 250% still had to go to court twice last year in condemnation proceedings.

Condemnations are apparently on the rise. The average number of condemnation proceedings instituted by the reporting utilities doubled from 1953 to 1957. Sixteen utilities had none in 1957, while one system serving about 200,000 customers had 100 and a large company had 109. The average for 1957 was ten. Asked how many condemnations they expect this year, 28 utilities replied "more than in 1957." Another 34 expect no change, and only five look for fewer condemnations than last year.

About 50% of the property owners settle with the utility after eminent domain proceedings have begun, according to the survey.

What's the picture from the public relations standpoint? Personal calls on the property owners is the approach used by most systems. Seven utilities put out booklets or brochures. About 15 make it a practice to have representatives on hand at meetings of zoning boards, civic groups, and planning commissions. Very few regularly spread information about R/W to utility employees, opinion leaders, or elected officials.

There is apparently very little effort made to publicize right-of-way matters. The survey asked the utilities how often this statement applies: "The less the public knows about our R/W operation, the easier the job will be." About 50% of the utilities answering the question said the statement applies most of the time. This

is no surprise considering the sudden appreciation of land values which sometimes takes place when speculators get wind of a transmission route.

Twelve utilities use contractors to acquire R/W's and sites—mostly on a "sometimes" basis. Twenty-five use outside agents. Nineteen others turn to outside help on occasion, but did not specify whether they used contractors, outside agents, or both. Most utilities call on them "sometimes" or "rarely".

When they hire a right-of-way agent of their own, most utilities look first for a man with a good personality and the ability to get along with people. Other qualifications that many utilities mentioned are real estate experience, salesmanship, and know-how about the utility's way of doing business—in roughly that order.

Only eight utilities provide some form of training other than on-the-job. These eight spend an average of $600 a year on training. As for on-the-job instruction, the new R/W agent works an average of four months with an experienced man or does routine office or field work before being sent out on his own.

How much do utilities pay right-of-way agents? Answers varied widely. Average salary for a new R/W man with two years of real estate, engineering, or utility background is $5,031. Generally the larger utilities in or near the big cities pay the higher amounts. Highest salary reported was $7,200 a year.

The ratio of R/W men to customers also varies from utility to utility. Consider these two large urban utilities, with about the same number of customers. One company employs an agent for every 60,000 customers; the other has one for every 200,000. And one medium-sized company has reduced the ratio to 1:7,000. There seem to be almost as many approaches to right-of-way organization, as there are utilities.

"Lead Time" Is Increasing*

	for Transmission R/W's	for Substation Sites	for Plant Sites
1957	23 mos	23 mos	4.2 yrs
1955	19 mos	17 mos	3.5 yrs

*(Average of 75 Utilities Reporting)

One trend that emerged from the survey is a stretchout of R/W lead time. The utilities are procuring rights-of-way farther ahead of the construction crews. Average lead time for transmission rights-of-way increased from 19 months in 1955 to 23 months in 1957. But over half the utilities still said their lead time is one year or less.

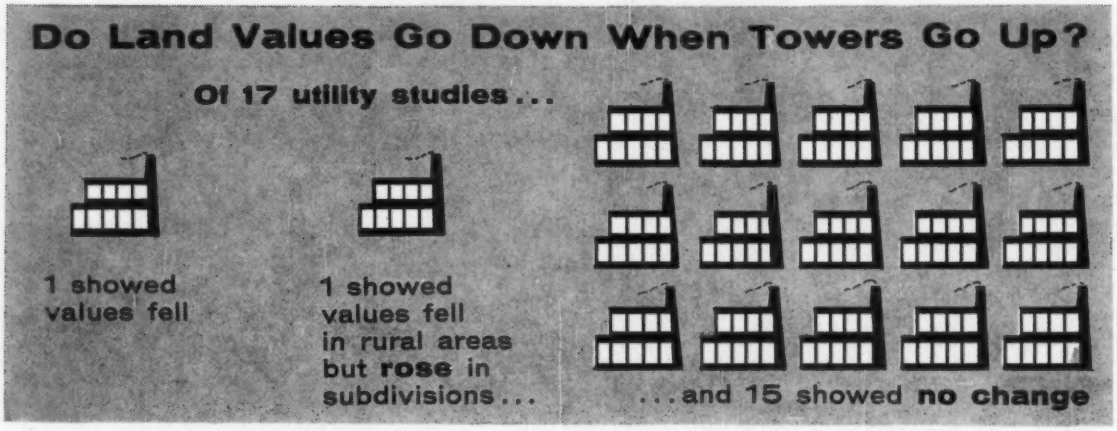
Much of the same holds true for substation site acquisitions. Present lead time averages 23 months, compared with 17 months two years ago. Not quite half report lead times of a year or under.

Plant sites are being acquired about four years ahead of construction crews, on the average. This is over six months more than the 1955 practice.

Forty-nine utilities reported there had been no change from the 1955 advance acquisition period to the year-end 1957 period. The "no-change" status is understandable for some systems. A company near the East Coast, for instance, has been acquiring transmission R/W's seven years, substation sites seven years, and plant sites 15 years ahead of construction. Another eastern company is continuing a five-year "buy ahead" policy for transmission and substation sites, and 8½ years for plants.

But there may be trouble brewing for about eight utilities of the 49 whose practices remain unchanged since 1955. The eight fall below the advance procurement averages—three of them, in fact, said they have no lead time at all on transmission. One land department head explained the lag behind system planning studies was due to a "shortage of engineering personnel that delays surveys and mapping."

Sixteen utilities plan to increase their lead time this year. Of these, six will keep pushing for advance acquisition time in subsequent years. Eighteen say they may up the '58 lead time. The utilities that say they will or may edge up this year hope to end up with an average of about three years ahead of the construction crews on transmission and substation sites and some five years ahead on plant sites.


Do Land Values Go Down When Towers Go Up?
Of 17 utility studies...
1 showed values fell
1 showed values fell in rural areas but rose in subdivisions...
...and 15 showed no change

Do transmission towers and substations lower the value of adjacent property? EW asked the question: "Have you conducted a study on the decrease or increase of values of land adjacent to line structures and substations?" Seventeen utilities have. In every case but two, the utility said there had been no adverse effect on resale values of adjacent property. One found that property values did decrease. The other found that land values went down in rural areas, but actually went up in subdivisions.

Seven utilities which had made no formal study said they had watched the situation closely. None of the seven had been able to discover any substantial effect on the property of adjacent owners.

But here's the rub—summed up by the R/W man from a large eastern utility: "There is no substantial decrease in values of land adjacent to line structures, but property owners will not accept our proof." It appears there's a tough selling job ahead.

Tampa Electric Names Two Vice Presidents

C. H. Schwaner and M. T. Anthony are two newly elected vice presidents of Tampa Electric Co.

Schwaner, who most recently served as treasurer-secretary, now becomes vice president of finance. He began his utility career 35 years ago when in 1923, after attending Texas Agricultural and Mechanical College, he joined Eastern Texas Electric Co as chief clerk. Then, after various positions with Western Public Service Co in Nebraska, he started with Savannah Electric & Power Co as treasurer and secretary. It was in this capacity that he joined Tampa Electric in 1947.

Anthony, general sales manager since 1955, now assumes the post of vice president in charge of sales. A former student at Massachusetts Institute of Technology, he entered the utility business in 1922, serving with what is now the Brockton-Edison Co. His next position was with Virginia Electric Co, which he joined in 1924 as a district sales manager. In 1927 he joined Western Public Service Co as sales manager. He has been with Tampa Electric since 1935, when he was named sales manager.

C. H. SCHWANER

M. T. ANTHONY

Dirksen Advances to VP Post

Peter C. Dirksen has been appointed vice president and general manager of the New Bedford Gas & Edison Light Co. Dirksen, who succeeds the late Ralph M. Miller, was also named to the board of directors of New England Gas & Electric Service Corp.

A registered professional engineer, Dirksen began his utility career with the New Bedford utility following his graduation from the Massachusetts Institute of Technology in 1924. He was advanced to general superintendent of the company in 1938 and to general manager in 1950.

PETER C. DIRKSEN

Lowe Assumes VP Position

Sierra Pacific Power Co has announced the recent promotion of B. E. Lowe to vice president and assistant to the president. Lowe joined SPP late last year from Trans-Canada Pipe Lines, Ltd, where he had served as sales manager.

His previous utility experience includes positions as division engineer for Southwestern Light & Power Co; research engineer at Continental Oil Co; manager of industrial sales for Southwestern Power Co; assistant to the VP and personnel dept head for Public Service Co of Oklahoma; and partner in Midwest Utility Engineers.

B. E. LOWE

(*More News about People on page* 112)

How Research Shapes Our Future Prosperity

If you are looking for an industry that is going to keep on booming in 1958 and every year for the next decade, here it is. It is the industry of technological innovation through research and development.

Last year this great new industry spent over $7 billion to discover and develop new industrial products, processes and equipment. This year the preliminary McGraw-Hill survey indicates that total expenditures for industrial research and development will be even greater, perhaps as much as $8 billion. Of the companies surveyed, 57% plan to spend as much as in 1957 and 38% plan to spend more.

The sustained expansion in research and development is the best guarantee we have that the current decline in business investment in new plants and equipment will be relatively short-lived. There can be no prolonged decline in investment in an economy where technology is changing rapidly.

This editorial is designed to show how the continued surge in research and development can be expected to lead first to new products, and eventually to renewed expansion of investment in new industrial plants and equipment. Such expansion is the essence of national economic growth.

A Slow Start

The impact of research on sales and investment is still very gradual. Research spending itself has more than doubled in the last four years. But only 32% of all manufacturing firms report significant capital outlays to make new products. We are not reaping the full dividends of industrial research as yet for several reasons:

- Research expenditures were relatively small until the Korean War of 1950 brought substantial government contracts in aviation, electronic and related fields. Heavy research outlays for civilian and industrial products came even later.
- There is an average *lag*, according to research directors consulted by the McGraw-Hill Department of Economics, of roughly seven years from the start of research until the product is ready for large scale output — about five years of research and at least two years to solve production problems and develop markets.
- Complex products, such as new consumer durables and industrial machinery, have an even longer time lag.

However, new developments are certainly underway. Research began to increase in all lines of business when Korean War restrictions and

the excess profits tax came to an end in 1953. The tax revision of 1954 added a new incentive by making research outlays deductible as a current business expense. By 1955, the research boom was on.

When Is The Payoff?

With a lag of about seven years, it will be the early 1960s before these new developments become a dominant factor in capital investment. But once the flow of new products and new processes starts, it will accelerate sharply — just as research spending has accelerated in the past few years.

By 1960, over $50 billion in sales will be coming from products not on the market as recently as 1956. Sales of new products will increase year by year, but they will gain most in 1960-1962, or five years after the recent spurt in research expenditures.

Capital expenditures to manufacture new products will also rise, but with a slightly longer lag. Here the sharpest rise should come in 1962-1965, as the new products reach a volume that calls for a significant amount of new capacity. In most cases, initial output of new products will come from existing capacity.

This timing of a new wave in capital investment appears logical on other grounds. Population experts forecast an upsurge in marriages and births around 1965. So by 1962, industry will be starting to tool up for new mass markets.

The important point is this: As we approach the 1960s more and more sales and investment will be in new products growing out of research. By 1960 well over 10% of manufacturing sales will be in new products not on the market in 1956.

Meanwhile — research will help stabilize capital spending by raising the level of modernization and replacement expenditures. Of course, research does not eliminate all the ups and downs in the demand for capital goods, for there remain variations in the amount spent to expand capacity. But a high level of modernization, to cut costs and improve quality, does put a floor under any drop in investment.

What To Expect

During the next few years we can expect an increasing flow of new materials, new metallic alloys, new machinery — primarily those developments coming out of long-established research programs in the chemical and electrical industries. Industry will make wider use of specialized computers and automated equipment.

But the dramatic payoff on research comes even later. In the early 1960s the consumer goods industries will begin tooling up for their really new products — things so basically new they can change the way a family lives. Such items as plastic houses, paper apparel, turbine autos are under development right now. But it will take several years to get costs down and for population and incomes to grow to the point where mass markets are created.

When we reach that point in the mid-1960s, there will begin the greatest surge of capital investment in all history. And then — around 1965 — the new processes (full automation, atomic power, continuous steel casting) which are the slowest and most expensive part of the research chain to develop, will come into play.

The combined impact of new products and new processes, to meet an expanding market, will thus be felt in the mid-1960s — eight to ten years after the recent sharp increase in research spending. The full impact is that far away because of the lags for applied research, pilot plant studies and market introduction. But to a large degree the prosperity of the 1960s has already been shaped by the research programs now underway.

This message is one of a series prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nation-wide developments. Permission is freely extended to newspapers, groups or individuals to quote or reprint all or parts of the text.

Donald C. McGraw
PRESIDENT

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R. F. HURLEY R. J. MORS

Benjamin Ups Two

Benjamin Electric Manufacturing Co has named R. J. Mors as general sales manager and Ray F. Hurley to the new staff post of industrial designer.

Mors, former assistant sales manager, began his long career with the company in the 1930's, when he joined the firm's sales service dept.

Hurley is former chief designer for Curtis Lighting, Inc. He will now work with Benjamin's product design, development, and engineering staff.

PERSONAL BRIEFS

Otto W. Sommers is new general manager of City Public Service Board, San Antonio . . . Clallam County PUD has appointed **Elmer B. Titus** manager at Port Angeles, Wash.

Pacific Power & Light has designated **Thomas M. Keenan** as assistant general manager in charge of the new division which combines the eastern and central Oregon service districts. He's replaced as Pendleton (Ore.) district manager by **Eldon Drennan.**

Earl H. Huck, formerly director of the training and personnel research division, has been promoted to assistant director of industrial relations at Cincinnati Gas & Electric Co. **Frank C. Neal** succeeds Huck.

At Consumers Public Power District, **Don Schaufelberger** became Lincoln chief engineer to succeed **R. J. Wolfe,** who has been assigned as CPPD's project engineer. **J. Denny Cochran,** continuing as engineering supervisor at Lincoln, will also have direct supervision of trans-

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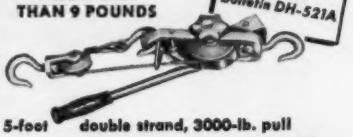

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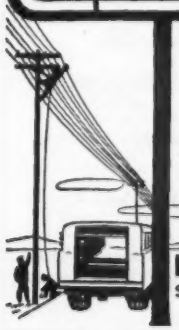

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mission, distribution, sub-station, and field engineers working out of the general office.

Robert E. Kane is now distribution design engineer at Union Electric Co . . . Central Illinois Public Service Co has advanced **M. A. Kirk** to manager of the newly established personnel and safety dept.

F. A. Ritchings has been elevated to assistant consulting mechanical engineer and **T. L. Sharkey** to assistant manager of the rate dept at Ebasco Services, Inc.

Atomic Energy Commission has assigned **Loren K. Olson** as general counsel and **Edward Diamond** as associate general counsel, the two top posts in the Office of the General Counsel . . . New member of California Public Utilities Commission is **Theodore H. Jenner.**

Robert B. Kurtz has been appointed manager of manufacturing for General Electric Co's general purpose control department . . . **William J. Grady** has been made manager of construction for Burns & Roe, Inc.

Graybar Electric Co has announced the following appointments in the Cincinnati district: **L. A. Russ** to operating manager at Evansville; **C. J. Fiely** to operating manager at Louisville on March 10, and **W. J. Hewitt** to supervisor at Lexington, Ky., on March 17.

Joseph T. Ryerson & Son, Inc, has advanced **Robert D. Allison** to general superintendent of its Pittsburgh steel service plant and **Robert T. Stafford** as general manager of the Seattle steel service plant. Stafford succeeds **W. Raymond Lockwood,** now manager of the Machinery Division.

OBITUARY

Lewis M. Smith, 63, vice chairman of the board of Alabama Power Co, died recently in his Birmingham home after a long illness. Smith, who had been president of the company until last year, had been active in Edison Electric Institute and was a former president of Southeastern Electric Exchange.

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The Meetings Calendar

MARCH

Edison Electric Institute—Annual Sales Conference, Edgewater Beach Hotel, Chicago, Illinois, March 24-27.

Institute of Radio Engineers—National Convention, Waldorf-Astoria Hotel and New York Coliseum, New York City, March 24-27.

Northwest Public Power Association—Engineering and Operations Section, Clark County PUD Electric Center, Vancouver, Wash., March 26-27.

American Power Conference—20th Anniversary Meeting, Sherman Hotel, Chicago, Ill., March 26-28.

Oklahoma Utilities Association — Annual Convention, Oklahoma Biltmore Hotel, Oklahoma City, Okla., March 27-28.

Pacific Coast Electrical Association—Engineering & Operation Section, Sheraton Palace, San Francisco, Calif., March 27-28.

Electrical Maintenance Engineers Association of Southern California—Industrial Electric Show and Conference, Shrine Convention Hall, Los Angeles, Calif., March 27-29.

Agricultural and Mechanical College of Texas—First Annual Texas Conference on the Utilization of Atomic Energy, College Station, Texas, March 31-April 2.

American Institute of Electrical Engineers and American Society of Mechanical Engineers—Southwest District Meeting, Mayo Hotel, Tulsa, Okla., March 31-April 2.

Southeastern Electric Exchange—Annual Meeting, Boca Raton Hotel and Club, Boca Raton, Fla., March 31-April 2.

APRIL

Rural Electrification Administration — 9th Annual Electric Generating Plant Operation and Maintenance Conference, Phoenix Hotel, Lexington, Ky., April 7-10.

Indiana Electric Association—Young Mens' Utility Conference, Evansville, Ind., April 8-9.

Microwave Research Institute — Symposium on Electronic Wave guides, held in cooperation with Institute of Radio Engineers, New York City, April 8-10.

• **American Society of Mechanical Engineers** — Production Engineering Conference, Bancroft Hotel, Worcester, Mass., April 10.

Rocky Mountain Electric League—Spring Conference, Shirley-Savoy Hotel, Denver, Colo., April 13-15.

American Institute of Electrical Engineers—Rubber and Plastics Industries Subcommittee, Mayflower Hotel, Akron, Ohio, April 14-15; Middle Eastern District Meeting, Washington, D. C., April 28-30.

Agricultural and Mechanical College of Texas—11th Annual Conference for Protective Relay Engineers, College Station, Texas, April 14-16.

Edison Electric Institute—National Conference of Electric and Gas Utility Accountants, held jointly with AGA, Shamrock Hilton Hotel, Houston, Texas, April 14-16; Industrial Relations Committee, Headquarters, New York City, April 17 Accident Prevention Committee, Commodore Perry Hotel, Toledo, Ohio, April 27-30; Purchasing and Stores Committee Meeting, Hotel Nicollet, Minneapolis, Minn., April 28-30.

American Welding Society—Sixth Annual Welding Show, and Technical Meeting, Kiel Auditorium and Hotel Statler, St. Louis, Mo., April 14-18.

Missouri Valley Electric Association—Engineering Conference, President Hotel & Municipal Auditorium, Kansas City, Mo., April 16-18.

Northwest Public Power Association, Inc.—Annual Membership Meeting, Ridpath Hotel, Spokane, Wash., April 16-18.

Southeastern Electric Exchange—Engineering and Operations Meeting, Buena Vista Hotel, Biloxi, Miss., April 21-23.

• **Bituminous Coal Research, Inc**—Annual Meeting of Members and Techno-Sales Conference, Penn-Sheraton Hotel, Pittsburgh, Pa., April 23-24.

Northwest Electric Light & Power Association—Engineering & Operating Section, combined with Personnel & Safety Section and Purchasing Committee, Chinook Hotel, Yakima, Wash., April 23-25.

Pacific Coast Electrical Association — Administrative Services Section, Hotel Valley Ho, Scottsdale, Ariz., April 23-24.

Pennsylvania Electric Association—Meter Committee, Galen Hall Hotel, Wernersville, Pa., April 24-25.

American Power Dispatchers Association—National Spring Meeting, Los Angeles, Calif., April 25-26.

MAY

American Society of Tool Engineers—26th Annual Meeting and Tool Show, Philadelphia Convention Center, Philadelphia, Pa., May 1-8.

Edison Electric Institute—Area Development Committee, New York City, May 1; Commercial Cooking Conference, Chicago, Ill., May 6.

Air Conditioning and Refrigeration Institute—Annual Meeting, The Homestead, Hot Springs, Va., May 4-7.

National Electrical Contractors Association — Districts Six, Eight, and Nine Annual Conference, Hotel Biltmore, Los Angeles, Calif., May 5-7.

American Public Power Association — Annual Meeting, Roosevelt Hotel, New Orleans, La., May 6-8.

Illuminating Engineers Society—Intermountain Regional Conference, Hotel Whitman, Pueblo, Colo., May 8-9.

• **Pennsylvania Electric Association**—Communications Committee, Mountain View Hotel, Greensburg, Pa., May 5-6; Electric Equipment Committee, Skytop Lodge, Skytop, Pa., May 8-9; Relay Committee, Hotel Cleveland, Cleveland, Ohio, May 15-16.

• **National Association of Purchasing Agents**—Annual Convention, Chicago, May 11-14.

• **Interstate Power Club**—Hotel Martinique, New York City, May 12.

• **Northwest Electric Light & Power Association** — Business Development Section Conference, Great Falls, Montana, May 19-21.

• **American Right of Way Association**—Electric Utility Section Meeting, Sheraton Palace Hotel, San Francisco, Calif., May 27; Fourth Annual National Seminar, Sheraton Palace Hotel, San Francisco, Calif., May 28-29.

• Additions this week.

MORE BIG DATES FOR '58

Edison Electric Institute—26th Annual Convention, Boston, June 9-12.

American Institute of Electrical Engineers — Summer General Meeting, Buffalo, June 22-27.

National Electrical Manufacturers Association—Annual Meeting, Atlantic City, Nov. 10-14.

National Association of Railroad and Utilities Commissioners — Annual Convention, Westward Ho Hotel, Phoenix, Ariz., Nov. 17-20.

— PROFESSIONAL SERVICES —

BLACK & VEATCH
Consulting Engineers
Electricity—Water—Sewage—Industry
Reports, Design, Supervision of Construction
Investigations, Valuations and Rates
1500 Meadow Lake Parkway
Kansas City 14, Missouri

THEODORE D. BROSS
LINE CONSTRUCTION CORP.
Steel Tower & Wood
Transmission Lines
Distribution & Maintenance
175 Endfield St. Hartford, Conn.

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Electrical, Electronic, Environmental, Photometric and Chemical Laboratories. Testing, Research, Inspection and Certification.
2 East End Ave. New York 21, N. Y.

HOOSIER ENGINEERING COMPANY
Erection and Maintenance of
Electrical Transmission and Distribution Lines
1384 Holly Avenue, Columbus, Ohio

JENSEN, BOWEN & FARRELL
Engineers
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Cost Trends—Reports
for Rate Cases, Security Issues, Regulatory and
Accounting, Requirements
Original Cost and Continuing Property Record
Determination
Ann Arbor, Michigan

PIONEER SERVICE & ENGINEERING CO.
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Engineers. . Purchasing
Specialists in Financing
Accounting and other Operations
231 So. La Salle St. Chicago 4

SARGENT & LUNDY
Engineers
140 South Dearborn St.
Chicago, Ill.

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Consulting Engineers
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Structural Design • Studies • Supervision
Power Stations • Transmission • Distribution
Industrial Plants • Process
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P-7435, Electrical World
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Address P-7553, Electrical World
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Distribution Transformer Designers electrical and mechanical
Outstanding growth opportunity with well established utility apparatus supplier located in midwest. Give complete details of experience with reply. Salary commensurate with ability and experience. Our employees know of this ad.
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Readers Forum

Another Boost for Perforations

To the Editor:

Our company has been regularly subscribing to your valued publication for many years and I have been regularly reading the 'Electrical World' for many years. I have been regularly marking and cutting out of your publication at least thirty pages from each issue and filing same in our company's special files for education of our senior personnel and ready reference.

I have, therefore, been very pleased with the pages now being perforated in your publication as this makes it very simple to tear out the pages and no longer have to cut off the ragged edges which are very difficult to avoid when tearing out the ordinary unperforated pages.

I also wish to congratulate your publication for the special inserts which you have recently established and these I am also finding most helpful.

You will be interested to know that I have two large separate filing systems, one being for technical articles and the other for non technical articles with a total of some 199 separate filing headings. I can assure you that the articles cut out by me from the 'Electrical World' over a period of many years are extra well represented as these files contain articles not only from technical and business magazines but also from newspapers. My personal experiences during over forty-six years in the electric utility business have proved these to be very valuable and most useful in my daily business.

Trusting that this information may be of some interest to you.

W. E. Spurling
General Manager and Secretary
Bermuda Electric Light Co., Ltd.
Bermuda

Word From Canada

To the Editor:

Referring to Mr. Taylor's recent letter, "The perforated pages in your magazine are the greatest invention since the wheel. . . ."

Quite So!

Nevo Marince
Montreal, Canada

Who Is This Man?

To the Editor:

We have been baffled by a most interesting painting, which we acquired a few months ago, of an electrical grandfather. Both English and American authorities with whom we have consulted failed to identify this important personage.

Do you think it feasible to run the attached in ELECTRICAL WORLD? It should be a point of some interest to the heirs of this early practitioner.

Bern Dibner
Burndy Library
Norwalk, Conn.

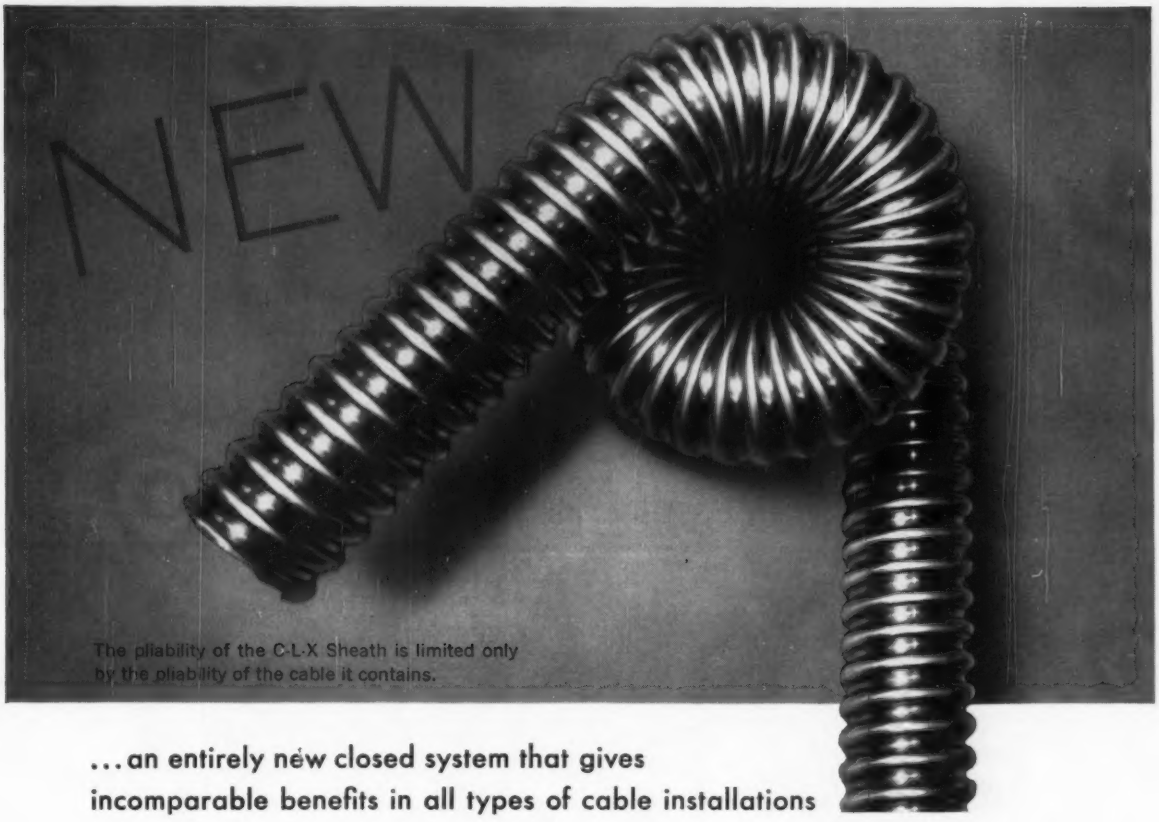
We invite our readers to help Mr. Dibner establish the identity of the sitter for the above portrait. The name of the painter, Thomas H. Gregg appears in three locations in the painting but no clue as to the name of the sitter has been found. The old signature at the bottom of the painting reads: "Painted 1838. T. H. GREGG. Fitzroy Sq." This name and address is repeated in the letter and envelope shown on the table.

London sources have not been able to identify the sitter although the records of the artist's exhibitions held in London have been combed for information. The Institution of Electrical Engineers in London and also the National Portrait Gallery, repository of the famous personages of England, could not identify the sitter.

A Leyden jar is held in his left hand and a Henley electrometer is held in his right. Pneumatic apparatus rests on a table at the left.

Simplex

ANNOUNCES the C-L-X* Sheath



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For more than a decade, this type of cable protection has given exceptional service in European installations. *Now, Simplex engineering has adapted C-L-X so that its scope of industrial applications is practically unlimited for modern American installations.* It is unequalled in situations where impermeability and durability are important.

Like all Simplex products, C-L-X is engineered for lasting quality and, therefore, *dependability*. Write for specific product data.

*(Continuous Lightweight eXterior, pronounced "Sealex")

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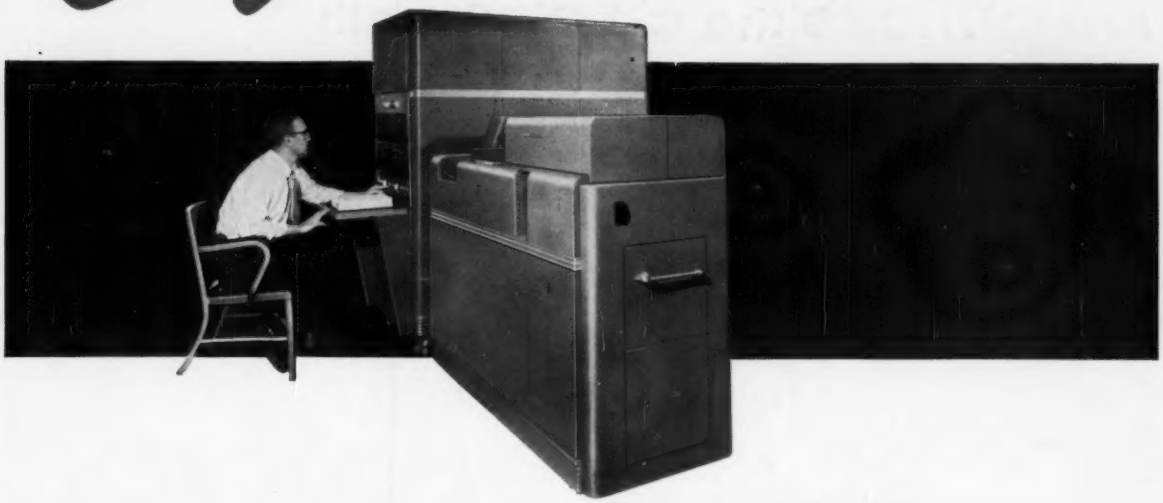
Simplex WIRE & CABLE COMPANY

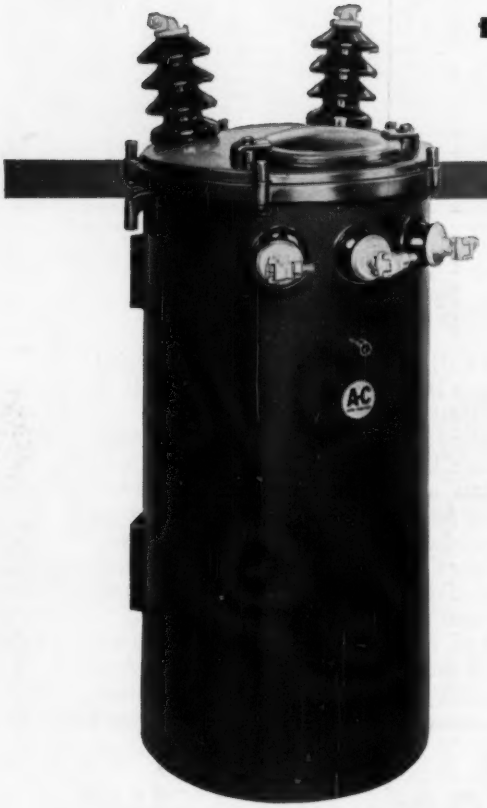
79 SIDNEY STREET, CAMBRIDGE 39, MASS.

"the American manufacturers of transoceanic telephone cables"

Craftsmanship at Allis-Chalmers



...gets an assist from the *Digital Computer*



In a continuing redesign program of distribution transformers, Allis-Chalmers engineers combine their skill with the electronic magic of a digital computer. Working with selected values for variables and with rejection criteria, the computer facilitates selecting the best possible transformer design.

Engineering Skill Vital

Obviously, the ingenuity of the engineer feeding data to the computer is all-important. The final choice of a design from the many acceptable ones produced by the machine is left to the experienced judgment of the engineer. The outstanding acceptance of the Allis-Chalmers redesign program speaks volumes for its engineering leadership.

Balanced Design Results

By combining engineering skill with the controlled data output of the computer, Allis-Chalmers has come up with a balanced design — a design in which each feature complements the others to provide unexcelled performance and long transformer life.

Get the complete computer story from your Allis-Chalmers representative or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wis.

ALLIS-CHALMERS

A-5488